SMITHSONIAN DEPOSIT

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Petroleum-Paraffine.

By A. W. Miller, M. D., Ph. D.

The manufacture and purification of paraffine are carried on in quite an extensive manner in Phi,adelphia. The establishments engaged in this industry are mostly situated on the eastern bank of the Schuylkill, in the neighborhood of Gray's Ferry Arsenal. The process begins by subjecting the so-called residuum of the petroleum refiners to distillation in large stills, made of five-eighths inch boiler iron, having a capacity of about 1500 to 2500 gallons. Direct heat is applied immediately beneath the stills, the bottoms of which toward the end of the process reach a white heat. The distillate is condensed in a system of iron pipes, which are contained in large wooden tanks. Distillation begins at 220°, and is terminated at about 580°. The product is a thick, unctuous mass at ordinary temperatures, but it liquefies at about 100°, or a little over. It has the peculiar iridescent color and the characteristic odor of petroleum. The residue of the distillation is a hard, porous, black mass, which is free from odor, and presents a close analogy to the ordinary coke of the gas works. In the yards referred to, it is in fact called coke, and is nsed as fuel to heat the stills.

The distillate, which has thus been obtained, is next treated with from four to five per centum of sulphuric acid, to *kill the green*, as it is termed by the workmen. After the removal of the acid by carbonate of soda, the oily mass is introduced into bags, made of the material called duck, each of which holds about three or four gallons. A number of these are then placed horizontally in an ordinary screw press, being superimposed on each other and separated by intervening boards. During the summer, it is necessary to use ice in order to lower the temperature and prevent too much loss of paraffine.

The oil expressed during this process has the gravity of 55° ; it is known as heavy paraffine oil, and is an excellent lubricator for cylinders. It can be readily deodorized and also freed from unpleasant taste, so that it may represent the softer variety of the so-called "cosmoline."

The crude paraffine, when taken from the presses, is melted and run into moulds. It is now of a light yellowish or straw color, rather soft, and still strongly redolent of petroleum. In this state it is sold to the refiners, who further purify it, in order to adapt it to the multitudinous purposes to which modern industry applies this valuable inheritance of prehistoric ages.

The refiners subject the crude article, which they designate as *wax*, to powerful hydraulic pressure, and thus obtain therefrom a second variety of paraffine oil of about 28° gravity. This is also used almost exclusively as a lubricator. The residue is further purified by treating it with a variety of gasoline or benzine of definite density, which is specially prepared for this purpose. Steam is also called into requisition in order to completely deodorize the product.

Two varieties of pure, white paraffine are manufactured, namely, the ordinary hard article having an apparently crystalline structure, and another having a softer and more gelatinous consistence, which is termed *gum stock*, and is chiefly consumed for chewing-gum. Some of the refiners consider these two products as separate and distinct bodies, and state that they cannot convert either of them into the other. One single refining establishment in this city is reported to find a market for an average production of these substances to the extent of 10,000 lbs. per month.

Among the more important applications of paraffine in our neighborhood may be enumerated its use for laundry purposes ; when added to starch, it imparts to it an additional lustre in the same manner as spermaceti or white wax. It has been found to be an effective preservative of wood, and large quantities are consumed in this industry. Chewing gum, as has been already stated, is the softer variety of paraffine ; although this is apparently a very trivial and non-important article, it is in reality sold in enormous amounts by many of the wholesale confectioners. The manufacturers of friction matches are heavy purchasers of paraffine, which they use for impregnating the sticks, so that they will more readily ignite, and burn with greater uniformity. Of late, paraffine is also beginning to be used extensively for the purpose of sizing various textile fabrics. Paraffine or ozokerite candles are well known, and they are confidently asserted to produce a finer light than any other variety. Confectioners also use paraffine to impart a gloss or lustre to some of their bon-bons, such as cream chocolate drops and others.

In Europe, paraffine has in addition been used for water-proofing various woven goods, for coating the interior of wine and beer barrels, for the preservation of fresco paintings, for the purpose of saturating cork and paper as a sizing or finish for leather and small articles turned from wood and bone, as a preservative of fruits and for many other similar applications. — *Amer. Jour. of Pharmacy, Jan.* 1. 1874.

Application of Meters to Street Lamps.

The Paddington Vestry have decided that the supply of gas to street lamps in that parish shall be regulated by meter, and to attain that object an application was lately made to the gas referees, under section 48 of the Imperial Gas Act of 1860, to prescribe and certify the mode of ascertaining the quantity of gas consumed by the public lamps.

The referees, Messrs. William Pole and A. Vernon Harcourt, in their reply, state that they have every confidence that the system prescribed in their communication will accomplish the desired end in a convenient way, and with justice to both parties. The communication in question prescribes that the meters which are to be enclosed in water-tight iron boxes, shall be of the most improved construction, and made by makers of acknowledged reputation, and shall be set into the ground at the foot of the lamp-column.

A meter is to be attached to every twelfth public lamp, and the average consumption of the lamps to which meters are attached shall be taken to represent the average consumption of each public lamp. The lamps are to be fitted with burners and governors of a precisely similar character, and those, as well as the meters, are to be tested, and put in repair if necessary, or oftener if the company wish to do so, at their own expense. The arrangements for lighting and extinguishing are left to the parties to settle amongst themselves ; but the referees recommend that, although under section 84 of the Act the maintenance and repair of the meters legally fall on the parish, the actual care of all the appurtenances should be vested by arrangement in the gas company, subject to inspection on behalf of the parish.

The register is to be read and recorded by two officers going round together on behalf of the parish and the gas company respectively, and if the record of a meter should vary more than twenty per cent. from the quantity it ought to consume, the record of the meter shall be omitted in taking the average, and the meter itself shall be tested and readjusted. Several minor regulations are laid down, and it is provided that all disputes shall be referred to an arbitrator, to be agreed on by both parties, or, failing such agreement, to be nominated by the gas referees.

According to competent gas engineers, the supply of gas by measurement to the metropolis would effect a saving of a halfpenny in the pound in the lighting rate, or about £40,000 per annum. Up to the present Paddington is the only parish which has adopted this system.—*Jour. Soc. Arts.*

That Bill Again.—Mr. Donahue introduced into the Legislature of New York, January 20th, a bill relative to the gas companies of New York and Brooklyn, which requires the gas to be of the power of sixteen sperm candles, and to be furnished at a price not exceeding $2 per 1,000 cubic feet. The mayors and boards of aldermen of both cities are to appoint an inspector for each city, who may appoint deputies subject to the approval of the mayors. The salaries are to be fixed by the mayors and aldermen. The duties of the inspectors are to test the gas at any time without notice to the companies. For violating the provisions of the first section, relative to the quality of the gas, a company is subject to a fine of $250 or $500. The companies are required to report to the inspectors at any time they may call for it, any information they may desire.

Chemical Repertory.

No. 105.—February 2, 1874.

EDITOR—HENRY WURTZ.

CHEMICAL EXCERPTS.

982. Pure Hydrogen.—Violette finds that if hydrogen is prepared from zinc, and purified according to the method of Dumas, it contains no gaseous compounds of carben. If instead of zinc, iron (whether wrought or cast) be used gaseous hydrocarbons are produced, and accompany the hydrogen. Whether carbon exists at all as an impurity in zinc is doubtful, if we consider the mode of its extraction.—*Academy of Sciences.*

983. Composition of Different Combustibles, Carbon as Unity.—

	Carbon.	Hydrogen.	Oxygen.
Wood	100	12·48	83·07
Peat	100	9·85	55·67
Lignite	100	8·37	42·42
Bituminous Coal	100	6·12	21·23
Anthracite	100	2·84	1·74

—*T. Wills, F.C.S.*

984. Coal Measures.—Prof. D. T. Anstel, a geologist of England, has recently made a survey of the coal measures of the Kanawha Valley adjacent to the Chesapeake and Ohio Railroad, and announced to the committee of the United States Senate, that iron can be made along the line of the Chesapeake and Ohio Railroad, "at half the price for which it can be made anywhere in England."—*Prof. Lesley's Railroad and Mining Register.*

985. Philadelphia Water-Works.—During the month of November, 1873, the number of gallons of water pumped into the reservoirs of the city was 1,121,617,063 gallons, distributed as follows: Fairmount works, 710,206,018 gallons; Schuylkill, 88,734,500; Delaware, 109,460,928; Twenty-fourth ward, 165,821,162; Roxborough, 47,294,455. An average per day of 38,891,829 gallons.—*Ibid.*

987. Oil Fields Comparatively Exhaustless.—It appears that the first oil field around Titusville, is again coming into prominence. Territory that was long since abandoned and thought to be worthless, promises to become as prolific as any in the whole oil region. Several wells recently put down in this territory flowed from 100 to 500 barrels per day, and promise to maintain a yield equal to, if not larger, than those in the Butler district.—*Exchange.*

987. This Winter's Ice Crop.—The warm winter which opened January so drearily, seriously threatens the ice crop, and if it continues as warm, will send all the local companies to the north of New England for their supplies. Ten days of continued freezing weather are needed to form twelve-inch ice, and ice of a less thickness costs much more to harvest. It takes about 1,000,000 tons of harvest, or 600,000 tons of actual supply to furnish New York and Brooklyn. The Hudson and a few lakes near New York furnish the greater part of the supply, and if the warm weather continues, there comes a heavy increase of expenditure for transportation. There will be plenty of ice in New England, however, and there is a large stock on hand, so that however high prices may go, there is little fear of a famine.—*World.*

988. Fire Escape for Safes.—American patent.—Charles Morgan, Philadelphia.—The safe is arranged between guide-posts which lead to a well ar hole in the ground below, and is supported by spring-pawls attached to its side, which pawls engage in ratchet bars attached to the guide posts. Spring-hammers, also attached to the safe, are held out of contact with the pawls, by means of lever-catches, which catches are kept in position by a yoke attached to a rope. Should any part of the rope be destroyed by fire, the spring-hammer will be released and caused to strike the spring pawls, disengage them from the ratchet-bars, and thus release the safe, which will fall into the well and escape from the fire. Thus valuable papers and securities may be preserved from the ravages of fire, and often times the most disastrous losses sustained from fires will be obviated.

989. Gas and Water Piping.—Vulcanized rubber coated iron tubes are now manufactured in Philadelphia, which will bear over 300 degrees heat, the rubber being prepared at 400° Fahr. The pipes can therefore be used for either hot or cold water. Gas and water are said to have no effect on them, and the coating resists sulphuric and muriatic acids and caustic potash solution. It is suggested that the process may be used for the preservation of iron ship plates and framing, if the rubber should resist the chemical action of copper in contact with iron under salt water.

990. Gaseous Exhalations of Plants.—M. Barthelemy, after a series of experiments on the above subject, concludes that in plants there is an insensible exhalation throughout the entire cuticular surface through the medium of a true gaseous dialysis; that there is an abrupt emission of saturated gases which escape by breathing apertures when the plant is submitted to a rapid elevation of temperature, especially when under a bell glass; and that there is finally an accidental exudation, the result of defects in equilibrium between the absorbent action of the roots and the work in the aerial portions, for the fixing of the carbon added to the elements of the water, a labor which ceases when light disappears.—*Sci. Amer.*

991. Oceanic Gases.—An examination of the amount of gaseous constituents in samples of deep sea water obtained during the "Porcupine" expedition of 1869-70, showed that both surface and bottom water contain more carbonic acid and less oxygen in the more southern than in the more northern latitudes, the examinations thus made embracing samples taken from localities extending from the Faroe Islands to Lisbon. Contrary to the general supposition, however, there is found to be no greater quantity of dissolved gaseous constituents in the bottom than in the surface of the water, although it is admitted that the power exists of pressure at great depths to retain gases in solution if once evolved there.—*Mining and Scientific Press.*

992. A New Lubricating-Oil Field.—The following is from the Butler *Herald* of 20th December: "We are in receipt of intelligence from the Slipperyrock oil regions beyond Portersville. Our informant says that one of the best wells in Pennsylvania is located about three and a half miles from Portersville, on Slipperyrock creek, near the line of Butler and Lawrence counties, which is actually producing 45 barrels of green heavy lubricating oil every twenty-four hours. The well is 225 feet deep. This daily production is worth $675 at the well. Here then is the beginning in another oil field which, in all probability, will afford all the lubricating oil required, and besides build up a section of country, which undoubtedly contains a vast amount of mineral wealth."

992. Gas-Well Items.—A three and a half inch casing has been laid from the gas well on the Dougan farm to the corporation limits, to supply the town, but the Common Council refuse to let the pipe be extended into the borough, and two great volumes of gas, each as large as a small tree, are burning at the end of the casing on the hillside, just opposite the borough.—*Parker City "Oilman's Journal."*

A new gas well has been struck at Painsville, Ohio, at a depth of three hundred feet. This makes four of these wells now in operation in Painsville.—*National Oil Journal.*

994. Lights for Vessels.—At a late meeting of the Manchester Scientific and Mechanical Society, a paper was read by Mr. J Hacking. One means suggested was by supplying vessels with feelers, in the shape of long poles fixed to their bows, which should signal the approach of danger. His next proposal was that every vessel should carry an apparatus composed of some flexible or rigid material, to be in readiness to place over any leak. A discussion followed, in which considerable doubt was expressed as to the applicability of the plans proposed. Prof. Reynolds said there was some difficulty in the adoption of the first plan, but he thought the second might be of service. Mr. Moorsom was of opinion that neither proposal was feasible. What was wanted was better lights, and he thought the time was coming when the electric light would be generally used on board ships.—*Iron.*

995. Composition of London Street Gases.—In a late article compiled by T. Wills, F.C.S., the following figures are cited, names of analysts, however, being unfortunately not given:

	Gr't Central.	Imperial.	Chartered,
Illuminating hydrocarbons	3·56	3·67	5·53
Marsh gas	35·28	40·66	55·26
Hydrogen	51·24	41·15	51·80
Carbonic oxide	7.40	8·02	8·95
Carbonic acid	0·28	0·29	
Nitrogen	1·80	5·01	0·38
Oxygen	0·44	1·20	0·08
	100·00	100·00	100·00

996. If?—The *Oilman's Journal*, of Parker City, tells us that "Eighty-two wells were sold in Butler county the other day, nineteen of which brought $72 each." In the same connection we may quote the following faintly facetious, or gloomily jocose observations from the *National Oil Journal*. It is to be feared that much heart-sickness, from hope deferred, may have passed under the inexorable hammer of the auctioneer "the other day," as above.

"If you don't reckon anything for the cost of engine and tools, it costs $4,100 to bore an oil well 1500 feet deep. A yield of 100 barrels a day, that is if it *does* yield that much, sold at 50 cents a barrel, that is if it *is* sold at that price, would, in eighty-one days, that is if the well held out so long as that, refund the original cost of the well, that is if the land did not cost anything, and if the well happened to *flow* all the time without any pumping."

997. Law for British Gas-Producers.—It appears that in England at least, gas companies have rights that their employees are bound to respect. *Iron* tells us that two gas stokers in the employ of the Surrey Consumers' Gas Company, at Rotherhithe, appeared the other day, at Greenwich Police Court, to answer to summonses charging them with neglecting and refusing to perform their contract work. The magistrate said their conduct had been the cause of much inconvenience and discomfort, and they would be imprisoned for twenty-one days in the House of Correction. On the intercession, however, of the chairman of the company, the sentence of imprisonment was commuted to a fine.

998. Bituminous Coal Trade.—The *Engineering and Mining Journal* of Jan. 10 says: The mildness of the season, together with the partial continuance of light work in the manufactories, has had its effect on the price of coal, in spite of the still determined combination, as we reported last week. It might be expected that bituminous coal would suffer a fall in consequence, but the fact is there is so little doing in that trade that prices are of no account. The extreme mildness of the weather, and consequent navigable condition of the streams, occasionally tempts some inland dealer to lay in a stock, while cheap transportation is still possible. But the great sources

of demand have been reduced. Foreign steamers bring all the coal they need, and as one dealer remarked, they seem to bring nothing but their own fuel. Freights have fallen off in amount so much as to have the most decided effect upon ocean transportation, and consequently upon the bituminous trade.

999. STREET-LAMP METERS. | The Borough Council of New England have adopted the plan of paying for the gas consumed by the street lamps, according to the quantity actually used, and have accordingly had a meter placed at the foot of each lamp pillar. The boxes containing the meters are not very ornamental in appearance, but they make admirable seats, for which they are extensively used by the inhabitants.

1000. STREET PAVEMENT.—A new street pavement has been tried in San Francisco. It is called "hydrocarbolised brick," and is made of bricks of a soft porous nature, which are boiled in coal tar, which, it is said, renders them tough, and nearly as hard as granite. A road bed is made by levelling the sand and packing it with water. A layer of prepared brick is then laid flatwise, each brick being dipped in boiling tar as it is laid down. This is overlaid by a second course of prepared brick placed close together edgewise, each brick dipped as before. The interstices are then filled with boiling tar, and the whole covered with a thin layer of screened gravel. The cost is about 36c. to 37. (about 3½d.) per square foot.

The Circulation of Water on the Surface of Our Earth.

[Concluded from page 40.]

But it is said that during the hot summer of 1822 the water in the mines of the Harz mountains collected to an uncommon depth, while at the surface all the springs were drying up. Is not this very simply explained by the fact that the soil, loosened by the high temperature, enlarged its natural capillary tubes to such a degree that they could no longer raise the water to the surface, and consequently the water gathered below? This explanation, to be sure, is very simple, but still clearer, no doubt, is the explanation that, as the water was pumped out by water-wheels propelled by brooks, the drying up of these brooks caused the wheels to stand still, thus stopping the pumping out of the water.

Generally, the water of the bored layers is in a state of rest, but frequently flowing; the plummet then suddenly sinks deeper down, and is set into a rocking motion, as in Paris at the Barrier de Fontainebleau, where it fell to a depth of 23 feet. At the gate St. Ouen, the third of five water-layers reached by boring, flowed so swiftly that the debris which the borer brought up from the lower layers were carried away by it; so that it was only necessary to raise them up to this layer, and not to the top of the well. How are such subterranean rivers produced? This can be distinctly seen in the Krain mountains. Here a more recent and firmer limestone is superimposed upon an older one in process of rapid disintegration. If the foundation-stone is decayed, the covering breaks down. In many hundred illustrations the depressions caused by this phenomenon can be seen on the railroad from Vienna to Trieste. If a river falls into such an opening, it disappears, and then reappears again at a great distance. When, during our travels, we inquired in the post-office nearest to the *perte du Rhone* about the way to the latter, the postmaster said: "You need not go there; in my garden you can see something far more remarkable." And, indeed, the sight that there met our eyes was surprising. We stood suddenly on the bank of a deep cut, perfectly dry river-bed, the rocky bottom of which was as porous as a sponge. If, now, the water of the subterranean river rises, it gushes through these pores and fills the whole bed. Livingstone saw even the mighty fall of the Zambesi river disappear in a deep ravine. Even in a plain something similar occurs, as with the Guadiana river, which for a time disappears under a large meadow, so that when the Spaniards are told of the great bridges in England, they proudly reply that in Estremadura there is one upon which 100,000 steers can pasture at one time. Sometimes these subterranean rivers flow only periodically, for which phenomenon we find the explanation in Greece.

Southern Europe participates in the sub-tropical rains which descend most violently in fall, and then continue through winter until spring, when they attain to a second maximum, while the summer is rainless. A portion of this water flows in Morea from the steep mountain-slopes immediately into the sea, while the rest is collected in the deep closed valleys of the interior and forms lakes. The lateral walls of these valleys are cleft in many ways, and thus form natural draining channels for the lakes, called Katavothra, when the level of the lake during the rainy season rises up to their mouth or above it. The exits of these canals are called river-heads, Kephalovrysi. In this manner the waters of the lake of Stymphalos form the Erasinas, those of the plain of Argos, near Mantinea, the Anavolo, and those of the lake Phenia the sources of the Ladon. Drama Ali, bey of Corinth, in order to prevent the closing up of the mouths, had gratings placed in three of them at Lake Phenia. At the beginning of the Greek war of independence these gratings were taken off, and thereby a rich plain was converted into a lake of 150 feet depth and 20,000 ft. mean width. Similar conditions are found in connection with the Copiac lake in Bœtia, between Mounts Helicon, Chlomo and Ptoon. In the month of August this lake is changed into a plain, with the exception of a small body of water near Topolia. Here nature has been aided by a widening of the Katavothra; and even in ancient times two artificial drains had been constructed. If these subterranean canals empty into the sea, sweet water-springs gush up from its bottom, as at Anavolo, near Artros, and on many points of the rugged coast of Argolis, Laconia, and Achaja. Such places were considered as sacred by the ancients, which accounts for the ruins of temples that are frequently found near them.

As a particular class, those springs deserve mention which originate from glaciers. They are formed by the water produced by the thaw on the surface of the glaciers, which penetrates into their crevices, where it continues to flow under the ice, until it finally often gushes forth from a splendid ice-grotto. The most beautiful illustration of these glacier-springs is found in the source of the Ganges, which, near the temple of Gangatri, breaks forth from a vertical ice-rampart as a river 120 feet wide. All these glacier-brooks, characterized by their white, soap-like water, flow more vigorously by day than by night, and the quantity of water increases with the temperature.

In consequence of the fact that the variability of temperature in the interior of the earth-crust is confined to a layer not quite 100 feet deep, springs exhibit a temperature so much the more uniform the deeper the horizontal portion of the *nappe d'eau* extends within the variable layer. In this respect a very great difference is found between springs issuing in close proximity to each other. In the watering-place of Marienberg, near Boppard—*e. g.*, according to the careful observations of Hallmann—the annual variability of the temperature of the air comprises 15° 72′; of the Michael spring, 7° 73′; of the Hassborn, 4° 77′; of the Muhlthal spring, 2° 00′; of the Hirschkopf spring, 2° 62′; of the Salzbrun, 2° 14′, of the Louisa spring, 0° 96′; and of the most important spring which feeds the whole watering establishment, the Orgelborn, only 0° 54′. And this difference is found not only to prevail among mountain springs, but also among those of the plain.

On penetrating into the interior of the earth beyond the variable layer of its crust, the temperature is likewise found to remain unchanged through the whole year, but to rise higher and higher the greater the depth to which we penetrate. While springs at the surface of the earth have an average temperature of 8°, the water from the bore of the well at Rudersdorf, 700 feet below the level of the Baltic, has a temperature of 18° 2′; in that at Rehme, near the Porta Westphalica, 2,144 feet deep, 18° 5′; and on boring the well of Grenelle, in Paris, the temperature at a depth of 1,683 feet was found to rise from 8½° to 22° 2′. The origin of hot springs, therefore, offers no difficulty of explanation, both as regards their temperature and its invariability. Nor is what has been stated in regard to this matter irreconcilable with the fact that, in consequence of earthquakes, springs often considerably change their temperature, for the dislocation of layers and rocks subsequent to such violent disturbances in the interior of our globe may either interrupt or open their connection with deeper layers. At the great earthquake of Lisbon in 1755, in the Bagneres de Luchon, the temperature of the Source de la Reine rose 40°, thus transforming it from a cold into a hot spring; while the opposite phenomenon, in consequence of the great earthquake of 1660, changed a hot spring at Bagneros de Bigorre into a cold one.

On its long subterranean travels the water generally meets with substances which it can dissolve. Even the ordinary spring-water is therefore chemically not as pure as rain-water; and, although the carbonate of lime which it contains in solution is found in it only in small quantities, they are nevertheless sufficient in contact with soap, to form a flaky lime-soap, while in rain and river water the soap is uniformly dissolved. It is also sufficient to prevent the swelling of boiling peas and beans, since the lime attaches to the skin and prevents the access of water. On that account spring-water is called hard, in contrast to soft river-water. The spring is converted into a mineral spring when it contains mineral matter in solution to a greater amount.

Regarding the formation of mineral waters, Pliny long ago pronounced the important fact: the waters are as the land through which they flow. Starting from this point of view, Struve examined the different varieties of rock in the vicinity of Bilin, Teplitz, Marienbad, Carlsbad, and Eger, and after having discovered in them all the solid constituents of the neighboring mineral springs, he attempted their artificial imitation by bringing the pulverized minerals under the pressure of a pump in contact with carbonic acid gas and water. His experiments were crowned with success, and the artificial mineral waters which he thus produced have proved to be of great benefit to suffering humanity, especially in regions at a great distance from natural mineral springs. The ocean is the mightiest mineral spring of the earth; but the uniformity of its composition, regulated by evaporation, external access of various substances and organic processes, can be fully understood and appreciated only by following the further wanderings of the water gushing forth from springs, in the form of brooks, rivers, and streams, over the surface of the earth—a theme which exceeds the limits of this discussion, and is deserving of a special investigation. It is thus the directly visible complementary link in that circular course of water, the first movements of which have so long been misunderstood, because going on in the air and under the ground, and thus being hidden from the observation of man.

The Marquette Gas Works.

The improvements at the gas works are now advanced to such a stage as to make their presence known throughout the city, in the steady supply of a good quality of gas. The works have been nearly reconstructed, and by the time contemplated improvements are made, the whole new work will be considerably more than was first put in, with the exception of the buildings. One new generating bench, with five clay retorts, is now doing all the work, but two other benches of similar construction are to take the place of those late in use. An annular washer, 9 feet high and 3 feet in diameter, has been set up. It is set vertically, and the gas passes up through a spray of water and is thus cooled and robbed of its impurities. Twelve condensers have been added. Four purifiers, six feet square, take the place of the one formerly in use. The gas is passed through three of these purifiers in succession, and all the tar and other impurities taken out of it, so that smoke and smell, or sediment will not characterize it hereafter. Formerly there was so much tar carried off with the gas that the service pipes would frequently become choked with it. A telescopic holder, 30 feet high and 50 feet in diameter, is being erected. This holder has a capacity of 50,000 feet. The purifying apparatus is set up in a new building erected for the purpose. Other improvements are being made, and the works will soon be in the most complete order. The company are indebted to Mr. Jas. G. Miller, a practical gas engineer, and the active co-operation of M. H. Maynard, president, for this work.—*Marquette Min. Jour.*, Jan. 13, 1874.

Petroleum Accident.—A frightful accident has occurred in the theatre at Ulm, France, through the use of petroleum. Twenty-four lamps attached to the chandelier suspended from the ceiling exploded while the performance was going on, and the flaming liquid fell on the spectators, among whom were a number of ladies. In an instant the dresses of some twenty were in a blaze. One of the ladies expired a few hours afterwards.

Mr. William Galloway on Fire-Damp.

[We extract the following from a prize essay on Mine Ventilation.—Ed]

Fire-damp is found issuing from the fissures of coal seams and the strata associated with them, the quantity emitted varying considerably according to the nature of the coal, and the depth of the seam from the surface.

In the workings of a coal mine the greatest quantity of the gas is emitted from the fresh surfaces which are exposed as the coal is removed at the faces in the "solid." Some gas, however, is also given off in the "broken" and in "goaves," being conveyed thither by fissures in the roof or floor, which act as pipes or channels from the solid coal of the working seam, or from an upper or lower bed of coal.

In general the quantity issuing from the solid coal, or from the roof and floor of the mine, does not vary much where the tension of the gas is considerable; but in collieries in which the fissures are wide, and the tension of the gas is not great, its rate of issue depends on the pressure of the atmosphere.

"Blowers" are usually large fissures, which extend for considerable distances in the coal field, and penetrate the strata both above and below the working seam. They sometimes give off a large quantity of gas when first "pricked," and some of them continue to emit gas for years. They are generally met with in the neighborhood of faults. Eruptions of fire-damp are not uncommon in some mines; gas in a state of great tension appears to collect in a cavity formed by the bending down of the roof or the heaving up of the floor, and to escape suddenly when a rent is formed, or a fall of roof takes place. Instances are also recorded of eruptions of gas from fissures filled with "danty" or disintegrated coal.

In the year 1815, Sir Humphrey Davy, who was at that time engaged in making the experiments which led to the invention of the safety-lamp, pointed out that light carburetted hydrogen was the principal constituent of fire-damp. Since then many specimens obtained from "blowers" have been analyzed; they are generally found to contain 80 to 90 per cent. of light carburetted hydrogen, varying proportions of oxygen and nitrogen, and sometimes a little carbonic acid gas. Light carburetted hydrogen is also known by the name of marsh gas, from the fact that it rises in bubbles to the surface of water under which organic substances are decomposing. A molecule of light carburetted hydrogen requires two molecules of oxygen for its complete combustion.

One measure requires two measures of oxygen, or ten measures of atmospheric air. When the air and gas are mixed in certain proportions, their combustion takes place with explosion. With five measures of air to one of gas, the explosion is weak; with from 8 to 10 of air to one of gas, it is most violent, and with fourteen of air to one of gas, the mixture still explodes. But when the proportion of air by measure is less than three or four, or more than fourteen, to one of gas the mixture will not ignite at the ordinary pressure and temperature. The composition of the after-damp depends on the proportion of air that was in the mixture before the explosion. When there have been ten measures of air to one of gas, the residual gases are one measure of carbonic acid, two of steam, and eight of nitrogen; and, after the steam has condensed, the after-damp occupies nine tenths of the original volume. It is, therefore, evident that there is no oxygen left in this or any after-damp which has been formed by the explosion of a mixture containing less than ten measures of air to one of gas. However, when there are fourteen measures of air to one of gas, the after-damp is composed of a 4-5 measure of oxygen, 2 of carbonic acid, and 11 1-5 of nitrogen, after the steam has condensed. This last mixture is not immediately fatal, and may support life for a short time after the carbonic acid has been removed.

Various methods have been proposed whereby it might be possible to penetrate the after-damp, such as the removal of the carbonic acid by the use of quicklime or ammonia and other alkalies; but, since the composition of the after-damp depends on the proportions of air and gas in the mixture before explosion, it would not, in some cases, be able to support life under any circumstances. The method employed for the detecting the presence of fire-damp in the air of a mine is by no means a satisfactory one, since a less quantity than three and a-half to four per cent. of gas gives not the slightest "cap" on the flame of a lamp or candle, and it must be remembered that 7 per cent. makes the mixture explosive. There is, therefore, only a margin of little over three per cent. between air that shows the first indication of containing fire-damp, and air that will explode. An instrument was described some years ago, by the aid of which it was said as little as one per cent. of fire-damp could be perceived; such a contrivance would be of much value in testing the ventilating currents, the fouling of which, even to the extent of one or two per cent. of gas, must, in many cases lead to the formation of explosive mixtures in places in which they had never been seen before.

Petroleum Gas.

The last number of the American Gas-Light Journal, in an article on petroleum, says that there is one town in the oil region (Tidioute) already lighted with petroleum gas. That experiments have also been made in Titusville, the special process used being that of Wren, and it would be gratifying to hear something satisfactory as to the success of these Titusville trials of Wren's retort for petroleum gas. For the information of that Journal we would state that the petroleum gas works in Tidioute is believed by Captain Butler, who built them, to be a success, and doubtless a full report of this new use of petroleum will soon be made public by that gentleman.

We are sorry to be unable to speak favorably of the Wren process, which was tried for some months at the Parshall Opera House, and also in McDonald's drug store in this city. The lights were smoky and highly odoriferous, and the result of the combustion was stifling, acrid, and disagreeable to the lungs. It was found necessary to send a man round during the performance at the Opera House with a piece of thin wire, to free the jets from accumulated deposit, and it became evident that its continued use would be prejudicial to the artistic frescoing of the interior. Mr. James Parshall, the proprietor, deserves great credit, however, for this attempt to introduce our staple article of commerce to a new use, even if it were a failure. Our Titusville coal gas works have a 22,000 feet holder, with a complete outfit of retorts, purifying house and apparatus apart from the coal gas works, with which they intend to demonstrate the practicability or impracticability of using petroleum as an article of, or as a substitute for coal gas. This apparatus is novel, simple, and does not interfere with any of the claims of existing patents.—*Titusville Herald.*

A Frightful Catastrophe.

EXPLOSION OF NAPHTHA AT BENNINGTON, VT.—NINE WOMEN KILLED.

The knitting mill of H. E. Bradford was burned on the afternoon of Tuesday, January 20, the fire being caused by a leakage of the gasoline pipe. The gas ignited from the boiler fire, and exploding, demolished the adjoining sewing-room. Nine women at work there were instantly killed by the explosion, or were burned to death in the fire which followed, and many others were injured shockingly. The card and sorting rooms were saved from destruction. The loss is about $60,000; insurance, $15,000.

[Regarding the above curious statement, we have met with nothing further, except that the explosion "is not attributable to carelessness." What the naphtha or gasoline pipe" was doing there, or what it was there for, *before* it exploded, is as yet to us unknown. —Editor.]

Circular to Gas Companies Regarding Insurance.

211 Chestnut Street, Philadelphia,
December 1st, 1873.

Dear Sir: At a meeting of the Gas-Light Association of the United States, held in New York on the 15th day of October last, the undersigned was requested by resolution to collect data, and confer with companies on the subject of insurance.

It has been suggested that a system of insurance upon the Mutual Plan might be adopted with advantage to the various companies interested.

Please return this circular with the blanks filled up. The object being at present only to obtain data.

Should companies generally favor the movement, and unite in it, it is believed the rates of premium will be low enough to make it an object for all gas companies to protect their insurable interests.

The occasional loss of holders by fire or explosion, and the losses upon coal from spontaneous combustion (though not frequent) do sometimes occur, add you are doubtless aware to such losses.

If sufficient encouragement be given, the plan when perfected, will be submitted for your approval.

Yours respectfully,
Wm. H. Williams.

[Accompanying the above was a lot of questions. Of course the complete circular may be obtained from Mr. Williams.]

Foreign Opinion of the New American Boulevard Lamp.—"In the proceedings at the Corporation meeting on the 22d ult., a communication concerning "The Bortlett" Boulevard lamp was brought before it. This lamp, now so much in favor in the chief cities of the United States, superseding the old square lamp, is a thick elongated glass globe resting upon a light iron frame, with a concave reflector around the body, throwing light downward, and a convex one encircling the chimney, throwing the light to a great distance. It is to be hoped that the civic authorities will be alive to these advantages, as from time to time additional light and new lamps may be required, and so supersede the old fashioned square lamp in the main streets and chief places of public resort by this neat, handsome, serviceable, and economical invention, adding beauty and lustre to the city. All who have visited New York may have noticed them in the main avenues, parks, and squares in that city, and the cost, although a trifle over that of the unsightly one now used, would be more than counterbalanced by its advantage and superiority of light."—*British Whig.*

Second Chemical and Sanitary Report upon the Water Supply of the Cities of Newark and Jersey City, in New Jersey.

By Professor Henry Wurtz.

To the Joint Comission of the Jersey City Board of Public Works, and the Newark Aqueduct Board.

Hoboken, October 1st, 1873.

Gentlemen: On the first day of July last, I first received from your honorable Commission, by the hands of his honor, Mayor Ricord, of Newark, definite written instructions, to renew and continue the investigation begun by me in Oct., 1872, by order of the Board of Public Works of Jersey City (of which a report was rendered by me under date of March 1, 1873, to that Board) upon the pollution of the Passaic River by sewage.

I was instructed to make chemical examination, also, of the water conveyed by the Morris Canal, regarding its availability as a source of pure water-supply to your two cities.

Much travelling had to be done by me in collecting samples, and in examining at different times the condition of the water in the river and the canal. By dint of unremitting confinement to my laboratory in the intervals, however, a great number of analytical determinations have been accomplished, leading to results of the highest interest, which include, I believe, full chemical data for the settlement of the important questions pending-questions which intimately involve the future welfare of your cities for all time.

FIELD-WORK AND COLLECTION OF SAMPLES.

July 8th and 9th an examination was made of the upper Rockaway, and of the Canal from Denville through Rockaway and Dover, and up to the Hopatcong feeder. July 23d the lower Passaic was carefully reconnoitred, from Newark up to Passaic, and four samples taken, at both extreme high and extreme low tide, at the Newark and Jersey City pumping-stations in Belleville. July 24th I drove up along the river and canal, very nearly to Beavertown, and back again, the waters being carefully inspected and examined at various points, including the canal feeder across Pompton Plains, which was followed on foot for a considerable distance. Samples were secured of the Passaic above the falls, of the Pompton feeder, and of the canal near Beavertown. The samples taken July 23 and 24 are of especial value and importance, as the river was then at about an *average* height, and not in the low state it usually assumes during that month. It will be recollected that the month of June of this year was exceptional, being the *very dryest*, and one of the hottest Junes on record, and that this drought continued till somewhere about the middle of July; but that during the latter half of July considerable rain fell.

July 28th an expedition was made up along the Rockaway River and Canal, from Rockaway to the foot of Lake Hopatcong, examining particularly the summit level, the Hopatcong feeder, and the lake itself, the shores of which latter were followed round on foot for a considerable distance. Samples were taken from the margin of the lake itself, that is, from the surface (there had been a very heavy rain during the previous night which had raised the level of the lake two inches), and from the outlet; the latter representing water emitted through a gate some ten feet below the surface of the lake. It was thought undesirable to take a sample from the feeder itself, as this *might* have shown fecal and urinary contaminations from the horses and boats occasionally traversing it at present. Should the feeder be closed to navigation, it will, of course, convey the water of the lake without such contamination, or, just as the analysis represents it.

On the 31st of August, Messrs. Bailey and Hartman kindly collected for me a sample of the water from the channel of the river, in Newark, at extreme high tide, off the Bridge street bridge. On the same day these gentlemen procured for me samples of the water from three of the public street *pumps* in Newark, which I have since examined, as set forth below.

During the month of August several successive appointments were made to make another expedition to examine the lower Passaic together, minutely, from Newark up to and through Paterson, as well as to collect samples of the August waters for analysis. These were all baffled, however, by the continuous rains, which kept the river somewhat flooded, even during that month, besides rendering exploring impracticable.

August 20th, another expedition was made to procure samples of the water in the city of Newark. Samples were taken—one from the channel off Madison street (below the discharge of the sewers), just before the time of ebb; a second from just above the opening of the Branch-brook sewer (the most northerly sewer), just after the beginning of rise of tide.

August 22d, a sample was procured of the water of the Atlantic ocean, in which I desired to make a determination of nitric acid, for comparison.

Finally, another opportunity was had by me to inspect the the condition of the river and canal at some points, during a journey along their line on September 22d.

Samples of Croton water were also obtained for comparative examination as regards chlorine and nitric acid.

The preservation of these samples of water during the summer heat in an unaltered condition being a problematical matter, the device was resorted to of keeping them in an ice-box provided specially for the purpose.

THE ANALYTICAL RESULTS.

All the results presented in this report were, as is habitual with me, obtained with my own hands, and by my own labor exclusively. The analyses were confined to the determination of the following, being those ingredients which bear, or are believed to bear, witness regarding sewage pollution.

The total solid constituents.
The loss on incineration, and the ash.
The nitric acid and nitrates.
The combined ammonia (including that of urea.)
The ammonia derived from proteine bodies.
The chlorine and common salt.

In order to secure uniformity for chemical comparison, it was obviously necessary to make all these determinations upon the waters after settling perfectly clear, that is, to confine myself to the ingredients in actual solution.

TABLE I.

Analytical Results upon Clear Settled Waters—Reduced to the U. S. gallon of 58,327·5 grains of distilled water.

Number.	(1) SAMPLES.	(2) Total solid Constituents.	(3) Loss on Incineration in Porcelain.	(4) Ash.	(5) Nitric Acid.	(6) Saltpetre, equivalent to the nitric acid	(7) Combined Ammonia.	(8) Urea, equivalent to the combined Ammonia.	(9) Ammonia derived from matters of Animal origin.	(10) "Albumenoids" (by Wanklyn and Chapman's hypothesis)	(11) Chlorine.	(12) Common salt, equivalent to the chlorine.
1	Newark Water Works—High tide—July 23	5.995	0.647	5.348	0.278	0.520	0.012	0.021	0.....	0.....	0.433	0.713
2	" " Low " 23	5.455	1.105	4.350	0.233	0.433	0.023	0.041	0.087	0.875	0.332	0.547
3	Jersey City " High " 23	6.178	0.722	5.456	0.374	0.700	0.....	0.....	0.029	0.292	0.288	0.476
4	" " Low " 23	5.407	1.175	4.232	0.374	0.700	0.....	0.....	0.012	0.117	0.216	0.356
5	Hopatcong, July 28—Depth of Lake	1.792	0.455	1.337	0.300	0.561	0.006	0.010	0.012	0.117	0.101	0.166
6	" " 28—Margin of Lake, after heavy rain	1.905	0.941	0.964	——	——	——	——	——	——	——	——
7	Morris Canal, near Beavertown	4.231	0.881	3.350	0.186	0.347	0.....	0.....	0.....	0.....	0.144	0.238
8	Canal Feeder, on Pompton Plains	3.332	0.764	2.568	0.139	0.260	0.003	0.005	0.029	0.292	0.115	0.190
9	Passaic River—head of Falls—July 24	4.584	1 501	3.083	0.334	0.624	——	——	0.023	0.234	0.252	0.416
10	Bergen Distributing Reservoir—June 23	4.203	1.117	3.086	0.280	0.520	0.023	0.041	0.044	0.437	0.288	0.476
11	" " " August 9	6.066	1.866	4.200	0.186	0.347	0.017	0.031	0.073	0.729	0.389	0.642
12	River in Newark—Flood tide—August 13	——	——	——	0.094	0.175	0.017	0.031	0.958	0.583	632.77	1042.733
13	Ocean Water—Coney Island Beach—August 12	——	——	——	0.094	0.175	——	——	——	——	——	——
14	Croton Hydrant—August 8	4.887	1.849	3.038	0.278	0.520	——	——	——	——	0.360	0.595
15	" " " 22, after heavy floods	——	——	——	0.185	0.347	——	——	——	——	——	——
16	River in Newark—just before ebb—August 20, 3 P.M.	5.249	1.575	3.674	0.187	0.350	0.058	0.103	0.117	1.167	——	——
17	" just after flow began, August 20, 3 P.M	5.833	1.458	4.375	0.037	0.070	0.029	0.052	0.292	2.916	——	——
18	Public Pump—Newark, Market street,—Register office	21.380	1.449	19.931	1.669	3.121	——	——	0.155	1.552	2.790	4.710
19	" " Cor. Orange and Broad street	21.290	8.750	12.540	1.853	3.465	0.017	0.031	0.070	0.700	3.100	5.233
20	" " Cor. Belleville street and 7th ave	15.400	7.410	7.990	0.555	1.038	0.026	0.010	0.078	0.776	0.930	1.570

The incineration was in every case conducted at the lowest possible temperature, in porcelain capsules, over Bunsen burners. The ash was in every case white, or nearly so, and is reserved for further examination.

For comparison, I add here another table, in which the results reported last March, upon the waters of October and December of last year, are arranged in a similar way.

TABLE II.

Number.	(1) SAMPLES.	(2) Total solids.	(3) Loss on Incineration.	(4) Ash.	(5) Nitric Acid.	(6) Saltpetre, equivalent to the nitric acid.	(7) Combined Ammonia.	(8) Urea equivalent to the combined ammonia.	(9) Ammonia derived from matters of animal origin.	(10) "Albumenoids," by Wanklyn and Chapman's hyphothesis.	(11) Chlorine.	(12) Common salt, equivalent to the chlorine.
21	Jersey City Water Works—Low Tide—Oct. 10, 1872	5.190	1.836	3.354	0.193	0.361	0.010	0.018	0.004	0.044	0.193	0.248
22	" " " High " " "	4.783	1.896	2.887	0.338	0.632	0.004	0.007	0.011	0.107	0.338	0.482
23	" " " Rec'g Res'rv'r "	4.767	1.442	3.325	0.241	0.451	0.009	0.016	0.008	0.081	0.241	0.356
24	Hoboken Hydrant, mean of Dec. '72 and Jan. '73	4.107	1.198	2.909	0.280	0.524	0.005	0.009	0.005	0.047	0.280	0.251

DISCUSSION OF THE ANALYSES.

I.—THE LOWER PASSAIC (BELOW THE FALLS.)

The analyses to be immediately considered under this head are numbered 1, 2, 3, 4, 10, 11, 12, 16, 17, 21, 22, 23 and 24

The Solid Constituents.—A number of curious facts are developed by an attentive study of the figures in columns 2, 3 and 4. But few can occupy space. In the first place, considering the ash, or fixed mineral matters—(column 4), it will be seen that there was more in solution during the rainy period—(Nos. 1, 2, 3, 4, 11), than during the drought—(No. 10.) The mean of 1, 2, 3, 4 and 11, is 4·717; No. 10 being but 3·086. Next, the high tide waters contain more mineral matter than the low tide; the mean of two results, closely concurrent in each case, being in the high tide—(Nos. 1 and 3), 5·402, and in the low tide—(Nos. 2 and 4), 4·291. This difference cannot be due to mixture of the upward tide with brackish water for the chlorine—(column 11), would then show it, but would seem clearly due to the mineral matters imparted in solution by the Newark sewage. Complete analyses only could show fully the nature of these changes.

The low tide waters contain much more volatile and combustible matter than the high tide, and during the flooded month—August (see No. 11), this underwent a further large increase. The substance brought in by the floods is, doubtless, chiefly vegetable or peaty matter. It will be observed that August 9th the ash was rather less than in July, though more than during the drought, in June.

Nitric Acid and Nitrates.—Here, the writer's results, *at first*, puzzled him somewhat. He had adopted, in the former report, the views of that school of chemists which deems the presence of *nitrates* to be the most valuable index to sewage contamination, at least in such cases as this, where no geological formation is concerned, which is liable to contain nitrates. As an example of the views of this school, Dr. Frankland said some four years since that, after the most diligent search he had "failed to discover the slightest evidence of the formation of nitrates from vegetable matters. Whenever nitrates are found in England or abroad, they can be traced generally, with the utmost ease, to animal sources, and whenever such sources are absent, nitrates are absent, too, although considerable quantities of combined nitrogen may be present. It would be a wonderful thing if the water of the chalk wells did not frequently contain nitrates, considering that it is derived by percolation from the sewage and manure-stained soil above."

A little consideration, however, and especially a little exploration along the banks of the lower Passaic, during the heats of summer, suggests most conclusively that there are, with us, very potent disturbing influences which, *in the summer season*, practically interfere with the chemical investigation of the nitrate question. Between Newark and Belleville the river, for long distances, was almost a continuous thicket or plantation of vigorous water-weeds, and the tide, while rising, was sifted or filtered through this immense mass of growing vegetable matter. It is no wonder, then, considering the well-known power of vegetation to absorb and assimilate nitrates and ammoniacal compounds, that, in summer at least, the proportion of these that would be expected to result from the drainage of Newark, should be disturbed. Hence it happened that the proportion of nitrates found in the upward and downward flows on July 23d, at the Jersey City Water-Works at Belleville, was found the same. This growth of weeds extended all along the channel, even above the Newark Water-Works. Hence the further loss of one-tenth of a grain per gallon of nitric acid during the flow of but one mile from the Jersey City up to the Newark Works.

In the fall or winter, however, after this vegetative process has ceased, the nitrate test for previous sewage contamination may doubtless be made use of—at least as a comparative test—though some further and still more remarkable facts yet remain to be set forth on this subject.

Combined Ammonia (Including Urea).—The proportion of this found in these Passaic waters, above Newark, is mostly so trifling that little can be deduced from it with certainty. In samples 16 and 17, however, which were procured with the express object of ascertaining the immediate effect of the fresh sewage of Newark (so far as might be), the figures mount up to something appreciable. In No. 16, which was taken just before the turn of the tide, at ebb, the amount of average *urine* itself indicated here is about three and one-half grains per gallon. It would appear, from the experience of many analysts, that during the warm season urea is so changeable and evanescent a thing, in river water, that it must be caught immediately, to be detected; and it is, therefore, probable that the amount of urine above estimated, 3½ grains per gallon, is much too low.* It must be pointed out, also, that in the low tide water at the Newark Works (No. 2), the indications of urea were unmistakeable, being doubtless due to the drainage from Passaic and Rutherford Park, above.

Animal Matters.—It is now well admitted as proved, that the ammonia obtained by distilling with Wanklyn and Chapman's re-agent (permanganate and caustic potash) is of animal origin, or at least from derivatives of proteine compounds, which are usually susceptible of putrefaction. It certainly furnishes us the most reliable test for putrefiable matter in water that we have up to the present time. W. and C. believed from their experiments, that such ammonia could be considered as indicating as much as ten times its weight of proteine matters. This my own experiments, furnish me strong reason to think to be (as a universal rule) an over-estimate; but I adopt their hypothesis in setting forth my results, premising that I deem it merely a hypothesis. In any case, the results have high value, if only as comparative, and not absolutely positive. It will be observed that the amount of this "albumenoid ammonia," as it is called in the books, in the tide just after the turn from ebb to flow in Newark, August 20, was nearly three-tenths of a grain to the gallon, indicating, according to the hypothesis, nearly three grains of albuminous matter, or say 12 grains of rotten egg to the gallon, from Newark sewage. This would be equal to one rotten egg in 66 gallons—instead of 200 gallons, as estimated in my Report of March last; without having then made actual analyses of the water in Newark. It will be also observed (on referring to No. 3), that when the up-tide flow reaches the Jersey City Works, the proportion has fallen to just one-tenth of this amount, and when the tide has risen to the Newark Works, one tenth of this amount, and when the tide has risen to the Newark Works, one mile more, there is *none* appreciable. [It must be recollected, however, that there is here an element of uncertainty, inasmuch as the Newark city sample referred to was taken at a different season from the others.]

Again, going down stream, it will be observed that the falling tide carries with it from the towns above, to the Newark Works nearly one grain of this class of compounds, which, while flowing along the mile reach to the Jersey City Works through and over beds of weeds, dwindles down to little over one-tenth grain. It must be remembered also that this part of the stream absolutely *swarms with fish*, which of course devour all animal matter in the water that is amenable to their digestion.

Unfortunately, however, there is evidence, even in this brief table of analyses, that all these influences, the atmospheric oxidation, the plant-digestion and the fish-digestion, acting together, cannot be relied on at all seasons and under all circumstances—or, it may be, at all hours of the day and, especially *the night*—to remove the whole of these dangerous putrefiable substances. Nos. 10 and 11, but particularly the latter, show this without the possibility of doubt. These two samples represent average water (high and low tide mixed) pumped up at the Jersey City Works, in two very different conditions of the river, one during drought and the other during flood. The sample of August 9 indicates an amount of "albumenoid" ammonia which I much regret to see, as it suggests that, under still more unfavorable conditions, which doubtless often exist (this having been a mere random hit), the proportion that gets into the reservoirs may be far larger.

The large proportion of "albumenoid"—0.875), brought down to the Newark works by the down-flow—(No. 2), indicates the probability that, at points further up stream, still more would be found, and therefore appears to tell strongly against the somewhat hasty suggestion thrown out in my report of March last, to bring the water by canals to the pumping stations, from points higher up stream, in order to get further away from the Newark sewers. We should thus be only getting nearer to the sewers that come in above. It must be remembered that the volume and the mean velocity of the down-flow must always be greater than that of the up-flow, and this is particularly so in times of flood. One result of these analyses must then be the definite abandonment on my part of the recommendation to take the water from higher up the river.†

I would suggest, indeed to your Honorable Commission, that the original location of your two pumping stations just where they are, was, in some sort, a providential circumstance. They *now* lie, however, in a critical location between Scylla and Charybdis, and must, I should think, before long, be swallowed up (metaphorically speaking) by the one or the other of these monsters.

The Chlorine and Common Salt.—These ingredients are regarded by many, as furnishing ordinarily more reliables evidence than any others, of previous contamination of water by sewage. As the evidence from nitrate fails us, in a measure, during the summer season at least, as a *comparative* test, I turn with much interest to the study of the chlorine determinations. They present points of value, and concur generally very well with the results of the Wanklyn and Chapman method: but unfortunately, in this part of the river, there is so much uncertainty with regard to possible admixture with the salt water that comes up to, or even above, Newark at extreme high tide, that I do not feel much confidence in these chlorine figures. The sample of high tide in Newark—(No. 12), was procured partly with a view to determine the amount of salt water that makes its way up to Newark at high tides. The result was, that *this* high water at Newark was *exactly two-thirds ocean water.* [I would call attention, also, to the curious fact that the amount of nitric acid in No. 12 is identical with that in the ocean water No. 13, the two being the poorest in the whole list, except No. 17. The animal matter in No. 12—(columns 9 and 10), doubtless comes from Newark sewage, which would accumulate in the water at flood, as at ebb.]

The chlorine test will be found of far more importance when we come to consider the waters of the upper water-shed, above the falls.

Further observations on the Lower Passaic.—A few further remarks will be made, arising out of the examination before spoken of, on July 23d, from Newark up to Passaic. I was struck with the filthy appearance of the water in the town of Passaic, and the large amount of effete dye-stuffs there cast into the river. Proceeding down the river from this town, it was found that the stream was actually blackened, and the stain continued apparent for more than a mile. It was also observed that even below the point at which the coloring matter had apparently precipitated, and the stream had become clear, the water had a distinct smell and taste of gas-tar, and films of tar were even occasionally seen floating thereon. This contamination must also have come from one or the other, or both of the towns above. The point where this taste was last observed was but a short way north of the viaduct of the Boonton branch of the Delaware, Lackawanna and Western Railroad. I may here add that films of gas-tar were observed by me on the water at the Jersey City Water Works in October of last year, but whether from Newark or from the up-river towns I could not say.

[To be continued.]

* A solution of urea in water decomposes spontaneously into carbonate of ammonia, which is very volatile and escapes quickly. One equivelent of urea and four equivalents of water are resolvable exactly into two equivalents of neutral carbonate of ammonia. Presence of animal matters acting as ferments, rapidly produce this change, and probably it is quicker also in the presence of basic carbonates.

† This suggestion has been taken up, as I observe (without credit), and made much of, by writers in the public press.

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessarily for publication, but as a guarantee of good faith.—ED.

Combination of Hydrogen Gas and Carbon.

JACKSONVILLE, ALBANY, Jan, 8, 1874.

Mr. Editor: You were quite right in presuming that the object of my communication, published in your Journal of January 2nd, was to "arouse useful discussion."

With regard to your desire that I should be more definite, as to what patents I referred to, I reply by stating—that during the fifteen years of my connection with gas works, numerous attempts have been made to cheapen the process of manufacturing illuminating gas, by what is called the water gas principle; in other words, generating hydrogen gas and, by some means, combining it with carbon to give it illuminating properties.

In every instance, so far as I have observed, those advocating this method have claimed a *chemical* union of the hydrogen thus produced, with carbon.

Without enumerating, it will be sufficient to call attention to an article by Mr. Allen, President of the National Coal Gas Company, published in your Journal of January 2nd, page 5, in which this result is emphatically claimed for water-gas produced under the Gwynne-Harris or American Hydrocarbon process.

If this is accomplished it is a very important discovery, and promises much to the manufacture of gas. If, on the other hand, there is no *chemical* union, only a *mechanical* mixture, it is of minor importance, and cannot, I think, seriously affect the method of manufacture now generally adopted.

You will find the extract quoted by me, in third edition of Clegg's work, published in 1859, pages 27 and 28. And on the 32nd page repeated in this form:

"Carbon exhibits no tendency to unite with hydrogen at any temperature, unless these elements are under the influence of vital force, as in the bodies of animals and the tissues of plants. Under this influence, however, they unite in almost innumerable proportions, forming a most extensive and highly important series of bodies known under the name of hydrocarbons." Respectfully yours,

J. O. KING.

Tar for Fuel.

BURLINGTON, IOWA, January 10, 1874.

Mr. Editor: The interest in the question of burning tar for fuel seems to increase daily, and I think the gas fraternity are largely, and I cheerfully acknowledge myself, personally indebted to Mr. Charles Nettleton of your city, for the information furnished through your Journal. After the publication of Mr. N.'s first communication I wrote him on the subject, and received a very prompt and courteous reply, together with a printed description, and a pencil sketch of his method.

Being desirous of trying an experiment immediately, I made my arrangements about one of our furnaces something after his plan—placed a small tank above the bench to be heated, connected a pipe with a cock to regulate flow, placed at lower end of pipe to conduct tar to tile, thence into the furnace. I was surprised at the success of my first endeavor, which worked to my entire satisfaction, except that the flow was very irregular, with frequent stoppages, so that it required constant attention. I was sorely perplexed, but after experimenting with it for a day or two, a change occurred to me which upon application was found to be an effectual remedy. It was this. I had a cock soldered on the tank, some four feet from the point of delivery on the tie and regulated the flow by that, leaving the lower cock entirely open.

Finding it work so well, I at once arranged for its permanent use. Instead of pumping the tar from cistern, I placed my tank at the end of hydraulic main, catching the tar as it comes from the main, with an overflow from the top of tank for the lighter liquids, and conducting it past two benches of retorts to the one already prepared for its use, through an inch pipe reduced to three quarter, after it comes to the perpendicular part. The flow is regulated at the tank. My apparatus is in other respects very similar to that described by Mr. N., with the "little appliance upon which the success of the whole operation depends," left out. I concur fully in what Mr. N. says of its advantages, after using it some months.

Respectfully yours,

R. SPENCER.

Burning Tar for Fuel.

GAS WORKS, HAMILTON, ONTARIO, January 15, 1874.

Mr. Editor: As you have frequently invited gas engineers and managers to express, through the medium of your columns, their opinions on the various subjects which are constantly brought under our notice in your valuable Journal. I would like to say a word or two in reply to two letters which have appeared on the subject of "Burning Tar as a Fuel for Heating Retorts."

Your issue of 16th December contained a letter from Mr. Charles Nettleton on the above subject, which is a most important one to both gas companies and to gas managers, and I think it cannot have too much ventilation. I was somewhat amused at the ingenuity displayed by Mr. N. in his tar mill; may he never have too much grist for that same mill. The contrivance described by Mr. N. seems to be better adapted for some very small works than for general adoption. It may perhps do in a works where the manager himself could be constantly on hand in the retort house, to superintend the mill. Now, in preference to this mode I would recommend another, viz., to inject the tar into the furnace in a spray. This may be accomplished by means of a tar burner, constructed on precisely the same principle as the oxyhydric burner, or the blow-pipe for gas and air. The inner tube conveys a small stream of tar, about the size of the stem of a clay tobacco pipe, and the steam passes down the annular space between the inner and outer tubes; the steam blows the tar into a spray and enables combustion to take place much more rapidly and completely than it would otherwise do; and Mr. N. would find it to his advantage to try this plan. He could easily, and at a small expense, erect a small boiler on the top of his retort bench, and heat it with the waste heat passing from the retorts to the chimney, he would find it a great advantage to have them at his command, to clear any stoppages in the pipes about the works from tar or naphthaline, and also for heating purposes, to keep the water in the tanks from freezing, etc.

In your last issue Mr. Somerville "relates his experience" in reference to tar fires. One cannot help admiring a man who is honest and candid enough to tell his professional brethren of his failures; but some of them will perhaps "be surprised to hear" such an admission from a gas manager at this time of day, especially when the thing has been successfully done over and over again.

Gas engineers in Great Britain have given great attention to the question of heating retorts with tar furnaces, those who have been most successful in this respect being Mr. E. S, Cathels (late of the Crystal Palace District Gas Works, and now of Montreal) and Mr. George Anderson. The first named gentleman has, I believe been more successful in the construction of furnaces and the setting of retorts, than any other man in England, and if Mr. Somerville will read Mr. Cathels's very valuable work on "Retort Settings," which is advertised in your columns, he may perhaps see reason to alter, and possibly withdraw the opinion "that the tar will not give out the necessary amount of heat to keep up a bench of five retorts." I have not the slightest hesitation in saying that not only beds of five but beds of fifteen, if it were required, could be as thoroughly and as effectually heated by a tar furnace, as they could be by a coke furnace. I have seen beds of seven large oval retorts set on Mr. Cathels's plan, heated to almost a white heat, and the bottom retorts as hot, or very nearly so, as the top ones. (This is owing to the peculiar arrangement of his flues.) The tar required to heat one of these beds is about 80 to 90 gallons in the 21 hours Now I can testify to these results from practical experience. I have set and worked retorts and furnaces set on Cathel's plan, and the best London settings for some years, and have now in operation at these works four beds of five set on Cathels's plan, and I am free to confess I have never yet met with any other plan or system of retort settings equal to them, either in the matter of fuel, which is such an important item, or in durability. I have worked them for four years without renewing, except the furnaces. Respectfully yours,

T. LITTLEHALES.

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MONDAY, FEBRUARY 2, 1874.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

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"MINERAL COKE," OR "CARBONITE," OF THE RICHMOND COAL-BASIN.

BY R. P. STEVENS.

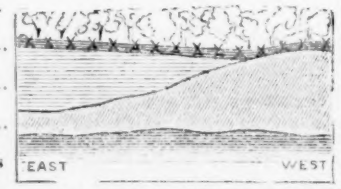
[NOTE BY THE EDITOR.—It was the intention of the undersigned to have appended to Dr. Stevens's valuable communication full statements of results of some chemical examinations, by himself, of specimens of this curious variety of coal. Room does not permit, however, and these will have to come in hereafter in a different shape.

Suffice to say now that the chemical characters show the designation "mineral coke" to be altogether a misnomer. It yields 12 to 14 per cent. of volatile matter, which, when the heat is applied slowly and cautiously, comes off and is condensable largely as a *colorless liquid*, that might be mistaken for water, but was found by the undersigned to be *combustible*! The mineral gives a brown streak, of a waxy lustre, and a brown powder. It is wholly soluble in nitric acid with a red brown color. More distinctive differences from *coke*, could scarce be demanded.

HENRY WURTZ.]

This very unique variety of coal is found north of the James River, and mainly in the colliery of the Virginia Coal Company, or lands immediately adjoining. Its relations to other seams is very well exposed by numerous shafts and working slopes. It is the upper worked vein, tending north and south, and dipping west 27° to 30° at the Edgehill slope. Above it, for roof, it has shales of crab, leaden, or dark color, often with impressions of ferns—then sandstone of dirty yellow color, containing calamites, sigillaria and asterophyllites, then shales, thin sandstones and clays to the summit. This seam varies in width from six to eight feet. Its floor is the common variety of stigmaria clay. Below it at 60 feet lies the second vein of bituminous coal, from six to seven feet thick.

SECTION OF VEIN AT EDGEHILL SLOPE.



West room coke; east room coke and coal. One half mile eastward there is but 2 feet coke in the vein.

The lower vein, and I believe none of the veins still lower than No. 2, worked on other land, ever exhibit any signs of carbonate, to use the newly coined name.

The striking peculiarity of this unique mineral is, that being closely associated with highly bituminous coal, it should have parted with its bitumen, lost to a great degree its lamination, and have put on the form of coke—a dirty black looking coke. How came about this chemical change? Prof. Wm. D. Rogers, who first wrote upon this point, and from whose description all others have been based, ascribes it to a dyke of trap lying above, and crossing this portion of the coal basin, near the boundary between the Trent and Virginia Coal Company's property.

In my examination of this region I have been led to doubt the efficacy of this explanation, for the following reasons:

1st. I failed to find in any shaft, slope, or natural section any signs of this dyke, or any change either in the overlying or underlying rocks.

The roof shale, when reposing upon the coke, never exhibited any change; its fossils were the same in appearance as when it reposed upon coal, or any other bituminous coal, and the same remark can be made upon the fossils and the sandstone above the roof shale.

2d. The changes that appear in the coke vein itself. Sometimes the whole eight feet of the vein is coke. In other cases it is a mixture of coke and coal, the coal appearing in its original thin layers in the coke, as if the conversion had not been perfected.

3rd. In other portions of the seam the lower may be coke and the upper coal—or it may be reversed, the upper may be coke and the lower coal. In others there is an alternation of coal and coke. In every case the roof shale remains the same. When "*troubles*" appear, it is the shale roof cutting out the coke or coal.

If the conversion of the bituminous coal into coke, had been effected by heat from an overflow of hot trap above, surely we should see some corresponding change in the superior rocks and fossils contained in them. I am led to infer a change produced by chemical action in the vein mass itself, possibly from dissociation of its sulphides.

THE NEEPIGON BAY TIN "BILK."

The years 1871-2 were famous—among other things—for two of the most extraordinary attempts to hoax the world into buying bogus mineral properties, that are recorded in all history. One was the Arizona diamond swindle, about which everybody knows everything; but of the other—the Lake Superior tin-swindle—much less is as yet known; though it appears to have been scarcely less ingenious, elaborate, and grotesque than the other, and to have manifested an equally sublime faith in the gullibility of Mankind. The locality for the experiment was ingeniously selected—considering the unusual combination of known mineral developments of the Lake Superior country, and particularly the wonderfully unexpected character of the recent discoveries on its North Shore, as at Silver Islet on the shores of Thunder Bay. People were prepared to believe almost anything of the mysterious North shore of this inland sea. As to the grotesqueness of the affair—when we learn that they actually *manufactured* a mineral vein (through which to *bleed* the public) having a gangue cemented with soluble glass—we seem to be in the midst of one of Jules Verne's pseudo-scientific extravaganzas.

The reason why space is given editorially to this subject, though it is quite outside of the usual scope of these columns, is that the name of the Editor of this Journal has been mixed up in this strange business; through the fact that this Journal was the first to bring forward reliable determinations of the quantity of in these bogus ores.

Dr. J. Torrey, since deceased, communicated the results of these analyses (made upon specimens submitted to him as U. S. Assayer) to the writer, who first communicated them, with the consent of Dr. T., to the public, through the Lyceum of Natural History, in New York, as well as through this Journal (Issue of May 16, 1862, pp. 159 and 162). From the latter it was widely copied. It is absurd, of course, to attach any responsibility in this matter, either to the lamented Dr. Torrey, or to the present writer; the latter having only quoted what "the parties who brought the samples said" regarding their origin and authenticity. This would be quite as unfair as to hold accountable any one, or more, of the numerous experts who merely pronounced on the genuineness of the gems, in the case of the diamond-hoax.

The conclusive evidence regarding this tin-hoax is comprised in the following extract from a letter of Mr. Wm. Harris, to the London *Mining Journal:*

"I found unmistakable evidence that by artificial means tin had been placed in the fissures and veins, probably in a liquid form which afterwards assumed the appearance of artificial stone containing the metal. As proof that such was the case I found buried near these veins *four barrels* of silicate of soda, a box containing clay, and other materials, which I suppose to have been used in carrying on the deception practised upon the gentlemen who made the necessary hasty examination in November, 1872, in company with Mr. Pennock. I found the original vein; the matrix had been worked out with a pick for some depth, and then filled with an artificial rock containing dressed tin of a high percentage."

The samples brought to Dr. Torrey were of

beautifully crystallized cassiterite, from some locality unfamiliar to that accomplished mineralogist. He called the writer's attention particularly to the peculiar aspect of the variety, as affording presumptive evidence of an origin hitherto undiscovered.—H. W.

DR. HAYES'S CONTRIBUTIONS.

In our last issue, the instalment there given, on the first page, of these extremely valuable articles, was inadvertently stated as "concluded." We rejoice to inform our readers that Dr. Hayes has no intention to break off here, and but for an attack of illness, would have furnished, in time for the present issue, further interesting matter.

From recent correspondence with this gentleman—which we have obtained from him permission to quote—the following involves a beautiful and ingenious application, to which Dr. H. will refer again hereafter in other connections.

"In connection with Air Gas I add, that in the study of the exact condition of vapor in it, I used dry carbonic acid gas to carry the volatile hydrocarbons. The suggestion arose—will the condensed oxygen of the carbonic acid gas, being highly heated previously, produce the high temperature to be expected in burning? I had only Fletcher's Hot Blast Blowpipe apparatus, and as yet have not reached a conclusion. But the gas made at 70° F. is the neatest plaything of all gaseous mixtures, its liquid-like characters allowing very funny surprises, while its incombustible base does not prevent quite a show of flame in air."

A WRIT OF ERROR.—"THE SANITARIAN."

In our notice of this new Journal, in the last issue, we somehow made a mistake in reckoning its dimensions, and observe now, on reviewing the February issue, that instead of 36 pages of reading matter, it has 48. Dr. Bell's remarks on general sanitary progress throughout the country are always interesting. In February he reviews what must be a very notable document, which we are unlucky enough not to have seen and profited by—the Report of the Board of Health of the District of Columbia. It seems that this Board have sent to Europe a homœopathic "doctor" named Verdi, whose report, as Dr. Bell says, accidentally of course, "opens with Gas." He does not appear to have gathered from the "Dr." any particularly new ideas, and finds, indeed, apparently nothing to approve of. Of one important topic he says that the reporter makes "no reference whatever to drainage for health, now in process of vigorous prosecution in many English towns, and fruitful in the most salutary results. This is the more surprising, since the District of Columbia is notoriously subject to malarious and other diseases, due to defective drainage." Of a great discovery by the President of this Board, Dr. Christopher Columbus Cox, of a new point of access to the public purse through the institution of a "National Sanitary Bureau," Dr. Bell speaks with becoming reprehension; sensibly pointing out that the Surgeon-General's Bureau is all sufficient for National purposes, and may be made a far more efficient basis for broad and general scientific investigation than any political ring organized in Washington.

PETROLEUM-GAS EXTENSION.

Among the patents extended for seven years, during the last year, we find the following. We quote from the *Patent Office Gazette* of Nov. 11, 1873:

26,028.—Improvement in Apparatus for the Manufacture of Gas, granted to L. D. Gale, November 8, 1859.—Reissued March 8, 1870, numbered 3,872.

Claim—1. The vapor-generator A, filled with hydrocarbon liquids by any suitable means, and provided with a vapor-pipe *i*, leading into a decomposing-chamber, E, substantially as set forth.

2. The combination, in a hydrocarbon gas-generator, of an inner retort, closed at both ends, with a space between it and the inner wall of the outer retort, whereby the hydrocarbon (solid or liquid) is first vaporized in the inner retort, and passes from thence into the space between the retorts to form a fixed gas, substantially as set forth.

3. The combination in a hydrocarbon gas generator, of two or more retorts, A^1 A^5 A^6, arranged together with a gas-back or decomposing retort, K, and exhauster L, wherein the retorts A^4 A^5 A^6 vaporize, retort K decomposes, and the exhauster L withdraws the gas, substantially as herein described.

26,030.—Improvement in the Manufacture of Gas, granted to L. D. Gale, November 8, 1859; reissued March 8, 1870, numbered 3,873.

Claim.—The treatment of all solid and liquid hydrocarbons by converting the volatile portions to vapor at a temperature below a cherry-red heat, and forcing the vapor so generated into contact with a red hot surface, and instantaneously removing the gas thus generated to prevent destructive decomposition, and thus form a permanent or fixed gas.

The very early date of these patents, almost simultaneous with the first development of the American petroleum-fields, gives them historical as well as technical interest. Among the depositions and other documents accompanying the case, which have been transmitted to us, we find some matter of general interest in connection with petroleum gas, which we may be able, in time, to put before our readers.

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The whole is, by permission, dedicated to Chas. Roome Esq., as Head of American Gas-Lighting.

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Retort Setting & Working,

Read at the Meeting of the British Association of Gas Managers in 1870, by E. S. Cathels, Ass. Inst. Civil Engineers England. To be had of Messrs. A. M. Callendar & Co., 42 Pine Street, N. Y. Price 75 cents

"The first paper read was on the Setting and Working of the Retorts, by Mr. E. S. Cathels of the Crystal Palace District Gas Works. This was an exhaustive, and to Gas Managers, an invaluable paper on the apparatus used in one of the most important processes in the manufacture of gas. It is a subject to which the author is well known to have given special attention, and we therefore commend his paper to the careful notice of those of our readers who are interested in the production of gas."—From a leading article in "Engineering" on 10th June, 1870. 345

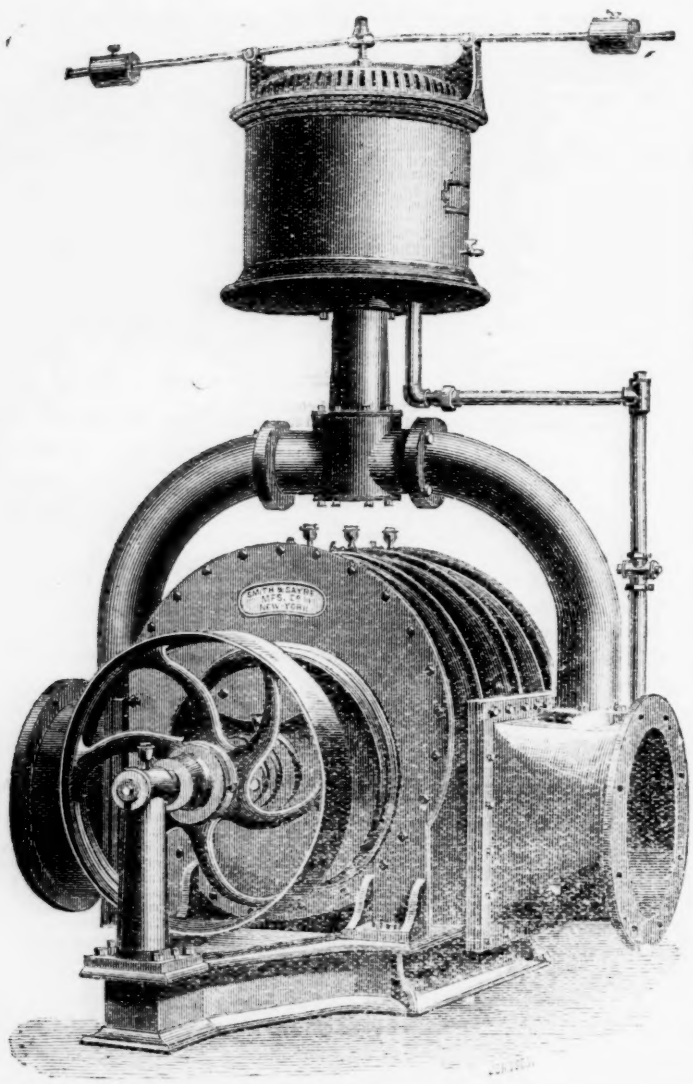
TO GAS COMPANIES:

WANTED—A SITUATION AS SUPERINTENDENT of Gas Works. Testimonials if required. Reference may be made to Joseph Light, Esq., Superintendent of the Dayton Gas-Light Company, Dayton, Ohio. Address John C. Westwood, care of B. R. Perkins, Esq., Superintendent and Secretary Columbus Gas-Light Co., Columbus, Ind. [348-4t

SMITH & SAYRE MANUFACTURING COMPANY.

The Mackenzie Patent Gas Exhauster

And Patent Compensator.



They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas, and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely the necessity of water-joints, is compact, durable, cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

We are also sole proprietors and manufacturers of the

MACKENZIE PATENT BLOWER, PATENT CUPOLA AND SMELTING FURNACE.

The Blower is a Force Blast machine, durably built, and can be driven with one-third the power required to drive the ordinary Fan.

The Cupolas are manufactured in sizes to melt from 1 to 20 tons per hour, will save one quarter of the time required by the old style Cupola, and 33 per cent fuel. Address

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JAMES M. SAYRE, Treasurer.

OFFICE, 95 LIBERTY STREET, New York.

CHARLES W. ISBELL, Secretary.

AMERICAN

GAS SCREEN MAN'F'G COMPANY.

TO GAS-LIGHT COMPANIES.

Your attention is respectfully called to the GAS SCREEN now being manufactured by the American Gas Screen Manufacturing Company, under the patents granted to E. DUFFEE, and are pleased to submit the following points of their excellence and superiority over all other screens now in use.

The Screen is made with an oak frame, interlaced with split rattan, drawn through holes at regular intervals in the Frame and cross-pieces, the edges of the frame being grooved prevent abrasion.

The advantages of the screen are:

1st. The large purifying surface, the construction of the Screen giving over three-fourths of the surface for the gas to penetrate the lime.

2d. On account of the free passage of the gas through the screen the pressure is reduced, thereby preventing the accumulating of carbon on the retorts.

The saving of lime and labor, as the Screens are not to clog, and are easily cleaned.

Their cheapness and simplicity of construction.

5th. Their DURABILITY—they can be used longer than any her now used.

Testimonials.

PROVIDENCE, RHODE ISLAND, March 21st, 1872

E. DUFFEE, Esq., Agent, etc.

Dear Sir: The Trays manufactured by you for our West Station were put in use in September last, and have *given perfect satisfaction.*

The frames are well put together, and I see no reason why ey will not last for a long time. The *very large amount of space* in these Trays gives the gas an easy passage, and brings it into contact with the lime much better than when the space is so contracted, as is the case in most of the other Trays in use.

The pressure thrown upon the retorts by contracted passages is very great, and were gauges used more frequently than they now are in many gas-works, this facat of having *open Trays* would become more apparent to mangers of gas works. The digerence in pressure at this station in passing the gas through your purifiers, is two-tenths (2-10) inches.

The amount of gas purified, per bushel of lime used to this date, is six thousand five hundred and fifty six (6,556) cubic feet.

Respectfully yours,
JAMES H. ARMINGTON, Supt.

BOSTON GAS-LIGHT CO., Dec. 1871.

Dear Sir: In answer to your inquiry how we like your Patent Tray for dry gas purifiers, I take pleasure in saying we have used them exclusive of all others, for the last three years, and think them far ahead of any yet offered. The surface being nearly three times that of any other Tray, and their lightness and durability perfectly satisfactory.

Yours respectfully,
A. M. GILES.

EDWARD DUFFEE, Esq.

EAST BOSTON, JUNE 15, 1871.

Gentlemen: We have used your Screens some five years. They give perfect satisfaction.

I consider them *by far the best Screen* for Dry Lime Purifiers I have seen. Yours truly, A. M. NORTON, Supt.

CHELSEA, May 1, 1871.

Mr. E. DUFFEE.

We are using your Purifying Trays, and find them to be the *best of any* that I have used, and will *purify more gas with less pressure* than any tray that I know. I can fully recommend them, after four years trial, to any Gas Superintendent with perfect safety, as the *cheapest and best Tray made.*

Yours truly, JOHN ANDREW, Sup't.

DORCHESTER, March 3. 1870.

Mr. E. DUFFEE.

Dear Sir: We have had your Gas Trays in constant use for almost one year and six months and find them superior to any others we have ever used, both in point of economy and efficiency. Truly yours, W. B. BROOKS,
Agent Dorchester Gas-Light Co.

JAMAICA PLAINS, MASS., June 21, 1871.

EDWARD DUFFEE, ESQ.

Dear Sir; The Trays ordered by this company three years ago, are getting somewhat worn. I wish to say here that I consider your Trays to be superior to any yet invented, therefore please make us another set at the price named, to be like the sample shown in every way, and oblige Yours truly
JAMES F. ROGERS,
Sup't Jamaica Plains Gas-Light Co.

BROOKLINE, June 11, 1871.

E. DUFFEE, ESQ.

Dear Sir: You will please make a set of Gas Trays for this company as soon as convenient, at price named. In regard to the merits of the Tray, after having them in constant use for over two years, I will say that I consider them *superior to any Tray* manufactured in this country. Respectfully yours,
H. A. ALLYN,
Sup't Brookline Gas-Light Co.

BANGOR, August 2, 1870

EDWARD DUFFEE, ESQ.

Dear Sir: Yours of the 20th ult. is received. In regard to your Gas Trays, I take pleasure in saying that they have been in use over two years, and have given perfect satisfaction and they are in good order at the present time; should have no hesitation in recommending them, believing they are the most durable and easiest kept in order of any with which I am acquainted. Respectfully yours,
W. H. PERRY, Sup't.

OFFICE OF THE SPRINGFIELD GAS-LIGHT CO.
SPRINGFIELD, MASS., Oct. 10, 1871.

Mr. WARD,
President Hartford Gas-Light Co.

Dear Sir: I have been using Gas Screens made by the American Gas Screen Company, for nearly a year, and find them superior in every way to the wooden Screens made and formerly used by the Springfield Gas-Light Co. I can purify more gas with the same quantity of lime, there being more surface to the Screens; and I consider them more durable, and recommend them to your consideration.

Yours with great respect,
GEORGE DWIGHT.

ROXBURY, June 14, 1872.

EDW. DUFFEE, ESQ.

Dear Sir: In answer to your inquiry regarding your Patent Gas Screens, I am happy to be able to say, that after nearly three years constant use we are perfectly satisfied with them being able to purify over fifty per cent. more gas with them, than with any other Screen we have used.

Yours respectfully,
THOMAS J. PISHOU

OFFICE DETROIT GAS-LIGHT CO.,
DETROIT, MICH., April 22, 1872.

AMERICAN GAS SCREEN MANUFACTURING CO., HAVERHILL.

Gentlemen: The Screens bought of you work far better than any we have ever used. As a proof, we have with the same quantity of lime purified *twenty per cent.* more gas with your Screens than with any others, and the work well done. The workmen are also better pleased with them—they being light and handy to work. They also relieve the pressure very much upon the retorts, and I cheerfully give you my experience.

Yours truly,
P. E. DEMILL. Secretary.

We give a list of some Gas-Light Companies using them.

Providence, R. I. Gas-Light Co.. Boston, Mass. Gas-Light Co.: East Boston, Mass., Gas-Light Co.; South Boston, Mass. Gas-Light Co.; Springfield, Mass., Gas-Light Co.; New Bedford, Mass., Gas-Light Co.; Manchester, N. H., Gas-Light Co.; Reading, Penn., Gas-Light Co.; Biddeford, Me., Gas-Light Co.; Hartford, Conn., Gas-Light Co.: New Haven, Conn., Gas-Light Co.; New Orleans, La., Gas-Light Co.; Savannah, Ga., Gas-Light Co.; Charleston, S. C., Gas- Light Co.; Trenton, N. J., Gas-Light Co.; Charlestown, Mass., Gas-Light Co.; Dorchester, Mass., Gas-Light Co.; Chelsea, Mass., Gas-Light Co.; Baltimore, Md., Gas-Light Co.; Manhattan, N. Y., Gas-Light Co.; Cincinnati, Ohio.; Gas-Light Co.: San Francisco, Cal., Gas-Light Co.: Albany, N. Y., Gas-Light Co.; Sacramento, Cal.; St. Joseph, Mo., Gas-Light Co.; Leavenworth, Kansas, Gas-Light Co.; Macon, Ga., Gas-Light Co.; Roxbury, Mass., Gas-Light Co.; Lansinghburg, N. Y., Gas-Light Co.; Bridgeport, Conn., Gas-Light Co.; Stamford, Conn., Gas-Light Co.; Poughkeepsie, N. Y., Gss-Light Co; Scranton, Penn., Gas-Light Co.; Lewiston, Me., Gas-Light.Co., and one hundred others.

Address **R. A. POTTER, Treas.,**
Amer. Gas Screen Man'f'g Co., Haverhill, Mass
EDWARD DUFFEE, Agent.

AGENCY FOR

GIBSON'S IMPROVEMENT

IN THE

Manufacture of Coal Gas,

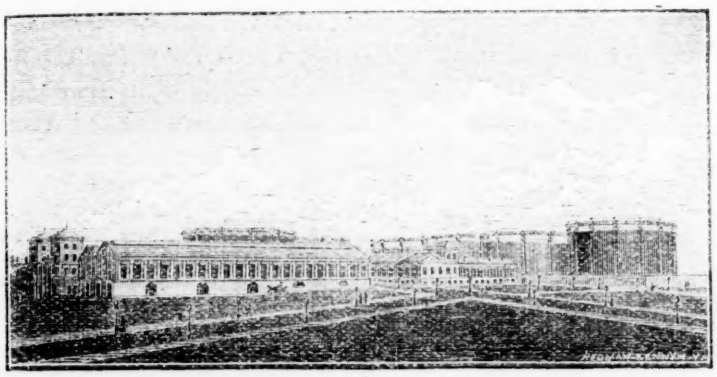
42 PINE STREET, ROOM 18.

The undersigned having been appointed Special Agent for the introduction of GIBSON'S Substitute for Dip-Pipes in the Manufacture of Coal Gas, respectfully presents for the consideration of Gas-Light Companies the Circulars and Pamphlet issued by the American Coal Gas-Light Imp. Co., descriptive of the value of GIBSON'S Improvement, and the mode by which Gas-Light Companies can satisfy themselves of its usefulness, without trouble or expense, at their own works.

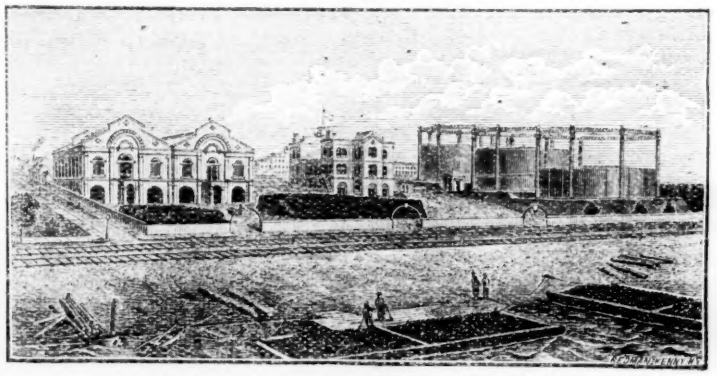
Orders for fitting up Valves of any desired form or patent, *subject to the generality of the Gibson claim*, and also for SUPPLIES and MATERIALS of every description required for the use of Gas Light Companies promptly attended to by

W. H. GRENELLE, Special Agent.

REFERENCE.—RICHARD MERRIFIELD, Esq., late President MANHATTAN GAS-LIGHT COMPANY.



CINCINNATI GAS-WORKS. ERECTED 1871-72-73.—WM. FARMER, ENG.



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WILLIAM FARMER may be consulted upon all matters connected with the construction of GAS WORKS, or any other description of buildings. Will furnish General and Detail Drawings, Specifications and Estimates for Gas Works of any capacity.

PATENTEE OF THE FOLLOWING INVENTIONS:

Exhausters for Gas and Foul Lime Ventilation,
Dumping Barrows for Coal, Coke and Lime,
Hydraulic Mains for Retort Benches,
Blowers for Forges, Foundries, &c.
Pumps for Water, &c., &c.

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Professor SILLIMAN, New Haven, Conn.
GEN. CHAS. ROOME, President Manhattan Gas-Light Company, N. Y.
A. W. BENSON, President Brooklyn Gas-Light Company, Brooklyn, N. Y.
W. W. SCARBOROUGH, President Cincinnati Gas-Light Company, Cincinnati, Ohio.
S. L. HUSTED, President Laclede Gas-Light Company, St. Louis, Mo.
Prof. HENRY WURTZ, Editor AMERICAN GAS-LIGHT JOURNAL, N. Y.
GEN. A. HICKENLOOPER, Vice-President Cincinnati Gas-Light Co., Cincinnati, Ohio.
FREDERICK CROMWELL, Vice-President Laclede Gas-Light Company, St. Louis, Mo.
C. VANDERVOORT SMITH, Engineer Manhattan Gas-Light Company, N. Y.
JAMES R. SMEDBERG, Consulting Engineer, San Francisco Gas-Light Co., Cal. [342

GAS PURIFICATION.

St. John and Cartwright's
NEW IRON COMPOSITION

Has purified, per bushel, on a single test, 10,000 feet of Westmoreland Gas. With revivification lasts indefinitely. Surpasses in POWER and ECONOMY all known materials. Saves largely in FIRST COST, SPACE, LABOR, SUPERINTENDENCE, and all current expenses. Will purify *easily* sulphurous gas, wholly *unmanageable by lime.* Takes out *all the ammonia.* Now operating in the following Gas Works: Harlem New York (21st street); Port Morris; Hunter's Point; East New York Worcester, Lynn and Cambridge, Mass.; Lewiston, Maine; St, Albans, Vt.; Pawtucket, R. I.; Meriden, Ct.; and being introduced in many other places.

Cost 70 cents per bushel. One bushel for each square foot of Purifier sufficient. Rights to use for life of Patents, for daily makes of gas in thousands; under 25,000 $200; under 50,000, $400; under 100,000, $500; $250 additional for each additional 50,000 per day.

For further information and instructions, apply to
ST. JOHN & CARTWRIGHT,
21st Street and Avenue A, New York Gas Works.

☞ Immediate arrangements are urged, as the demand for e prepared composition is increasing *so rapidly* that delays supply may occur.

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MANUFACTURER OF

Cast Iron Pipes and Fittings,

AND

Gas and Water Mains.

All sizes from 3 to 30 inch cast vertically in 12½ feet lengths

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OHIO GAS CANNEL,
From the Sterling Colliery.

We are now prepared to place in the market, through our agents as below, a regular and unlimited supply of this valuable Cannel, for gas purposes. The analysis made in 1871 by Prof. WURTZ, Editor of this Journal, at the Laboratories of the NEW YORK GAS-LIGHT COMPANY, gave 47½ per cent of Volatile Matter and 45 bushels to the ton of a fair quality of coke. The yield of gas was at the rate of 9,500 feet per ton of about 27 candle power. It is not highly sulphurous, can be purified by Lime, and the ash from the coke does not clinker. The above test has been fully substantiated as correct, and can confidently recommend trial of the coal.

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Cast and Wrought Iron Work

Used in the Erection of Gas and Coal Oil Works.

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Wrought Iron Roof Frames,

For Retort and other houses. Retorts and all castings required for setting them in the latest and most improve model. WASHERS, CONDENSERS, SCRUBBERS and EXHAUSTER for relieving the Retorts from pressure. PURIFIERS, varying from 2,000 to 2,000,000 cubic feet daily purifying capacity.

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With cast iron guide and suspension frames. GAS GOVERNORS or REGULATORS, STREET MAINS, from 1½ to 48 INCHES DIAMETER, for WATER or GAS. Street Main connections, such as BRANCHES, BENDS, DRIPS, SLEEVES, etc.

STOP VALVES, from 3 to 30 inches, for both Water and Gas.

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All the Smith and Sheet Iron work required in and about Gas Works. 226-tf

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PARTIES WRITING TO THE UNDERSIGNED ON G Matters, will please address J. B. CHICHESTER
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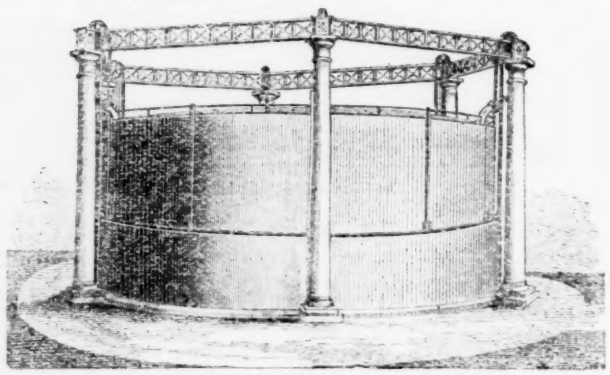
COAL, CARS, PURIFYING BOXES, COKE BARROWS.



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FOR TOWNS AND MANUFACTORIES.

Estimates furnished of the cost of Works, and cost to Manufacture Gas in any Locality.

Gasholders,
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Special designs furnished for Gas Fixtures for Churches Halls Lodges, &c.

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Single and Telescopic.

WROUGHT IRON ROOF FRAMES,

COAL WAGONS,

COKE BARROWS,

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Wrought Iron Work

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☞ Particular attention paid to Extensions and Repairs.

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PIPE CAST VERTICAL.

1½ to 48 inches diameter.

Cast Iron Flange Heating and Steam Pipe.

STOP VALVES FOR WATER OR GAS, ALL SIZES.

Fire Hydrants,

GAS HOLDERS,

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☞ Castings and Wrought Iron Work of all kinds for Gas Works 253-6m

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MADE FROM BEST MALLEABLE IRON AND STEEL.

FURNISHED WITH LONG OR D HANDLES

Perfect in their operation, a very strong, and from their great durability vastly more economical than any substitute. Refer to all the principal gas Companies in the country, who acknowledge them as the "ne plus ultra of Coke Screening Shovels.

Orders addressed only to

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Sole Agent,
No. 96 Maiden Lane, N. Y.

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Gas Companies, and all parties using Screening Shovels are cautioned against the purchasing (or manufacturing) of any other than myself, or my agents, COKE SCREENING SHOVELS, made either in whole, or in part, of **Malleable Iron,** as such is decided to be an infringement of Butler's Patent of June 4, 1872.

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96 Maiden Lane, N. Y.

THE CAMBRIDGE GAS-LIGHT CO.

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Fourteen lengths of Hydraulic main, 16 inches diameter, 7 feet 7 inches long, 5 holes for dip pipes.
Seventy Dip Pipes, 5 inches diameter.
Seventy X Pipes, 5 inches diameter.
Seventy Stand Pipes, 6 to 5 inches diameter.
Seventy Mouth Pieces for 6 inch Stand Pipes.
One set Condensers, 14 inch Pipes with 6 in. internal Pipe.
One Exhauster with Compensator, Governor, Valves, Pass, by and Connecting Pipes, 8 inches diameter, made by Smith & Sayre, in use but a short time; capacity 12,000 feet per hour; has delivered 16,000 with ease; amply sufficient to deliver 350,000 feet a day.
Four Purifiers, 10 by 16 feet, 5 sets trays, 8 inch connections, all in perfect order except the covers.
Wet Centre Seal for the same.
Two sets Hoisting Gear for covers.
Also a Station Meter with 10 inch connections; made by Tufts; has been run but a short time, in perfect order. Capacity 15,000 feet per hour.

Any part or the whole of the above will be sold very cheap, and delivered in sixty days.

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Portland Cement,
Roman Cement,
Keene's White Cement,

Numbers 1 and 2.

From best London Manufacturers.

FOR SALE BY

S. L. MERCHANT & CO.,

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DESPARD COAL

To Gas Light Companies throughout the country.
Agents, PARMELEE BROTHERS, No. 32 Pine street, N. Y
BANGS & HORTON, No. 31 Duane street, Boston.
Mines in Harrison County, West Virginia.
Wharves Locust Point, } Baltimore.
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*** Reference to them is requested 204-1y

FOR SALE.—TWO IRON TRUSS RETORT HOUSE Roofs, with Ventilators, complete; as good as new. One of them will cover a building 28 feet by about 75 feet; the other 30 feet by 45 feet or 50 feet, all in the clear. For further particulars address F. A. SABBATON,
341-tf Sup't Troy Gas-Light Co., N. Y.

EVENS & HOWARD,

Manufacturers of a superior quality of

Fire-Brick, Clay Gas Retorts,

Gas Tile, Drain Pipe, Fine Ground Fire Clay, &c.

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313-3m

Bird, Perkins & Job,

IMPORTERS OF

GAS COAL,

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WAVERLY CO. YOUGHEOGHENY COAL.
RED BANK MINING CO.

Special attention given to executing orders for **Gas Coal** for shipment to the WEST INDIES and other foreign markets.

SOUTH ST., N. Y. 103 STATE ST., Boston. [24

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AND PIPE WORKS.

OFFICE AND WORKS—CARROLL, PIKE, SMALLMAN AND WILKINS STREETS,

PITTSBURGH, PA

WM. SMITH,

Manufacturer of all kinds of GAS and WATER PIPE BRANCHES, CONNECTIONS, T's, ELBOWS, and all CASTINGS USED AT GAS AND WATER WORKS,

We offer special inducements to parties wishing to purchase. My Pipe is Smooth, regular in weights, and cast vertically.

N. B.—Pipe from 3-inch and upwards, cast in 12-ft. lengths.

☞SEND FOR CIRCULAR AND PRICE LIST.☜

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MINED IN TAYLOR COUNTY, WEST VA.

Company's Office, 52 S. Gay St., Baltimore.

CHARLES MACKALL, Secretary.

CHARLES W. HAYS, Agent, Room 7, 111 B'way, N. Y.

SHIPPING POINT—Baltimore, Md.

This coal yields 10,000 cubic feet of Gas, with an illuminating power of over 16 candles. Forty bushels of very superior Coke, with little Ash, and scarcely any clinker. 304-1y

NEWARK GAS BURNER MAN'G CO.

Manufacturers of all the

NEW AND IMPROVED

BRASS GAS BURNERS.

The *best* Gas Burners in the World for Street Lamps; also for Portable Gas Machines, to order.

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J. H. JUDKINS, Pres't. H. G. AVERY, Sec'y.

37-3m

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EDITOR—PROF. W. H. WAHL, PH.D.

ASSISTED BY THE COMMITTEE ON PUBLICATIONS.

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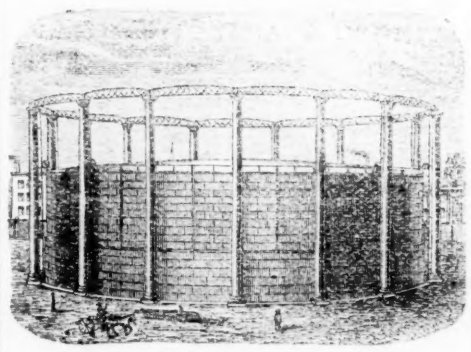

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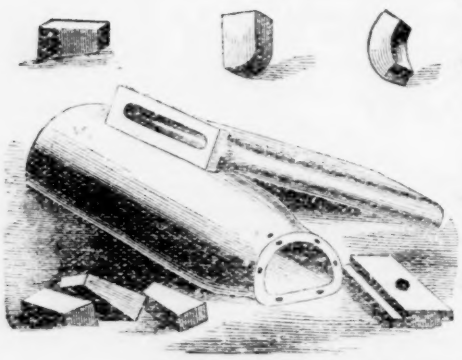

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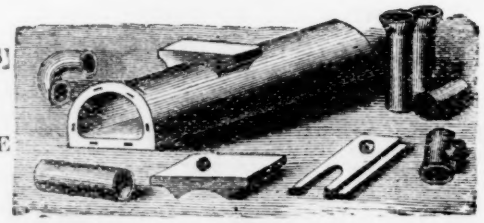

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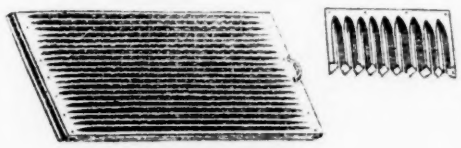

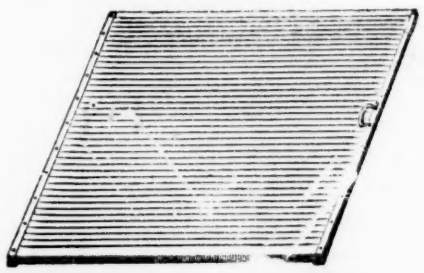

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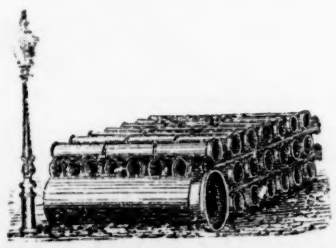

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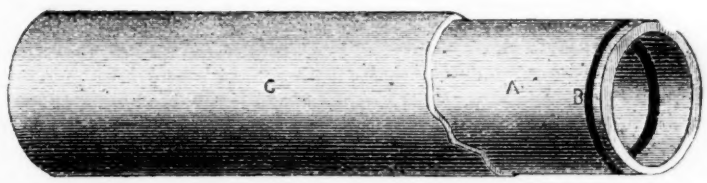

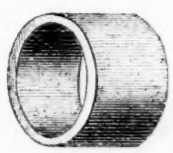

FIG. 2.

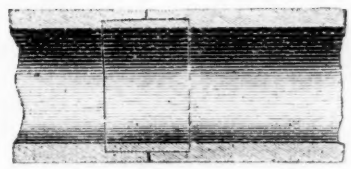

FIG. 3.

A—Cylinder of Wood. B—Band of Iron. C—Coating of Hydraulic or Asphaltum Cement.

FIG. 2.—Thimble for Connection. FIG. 3.—Horizontal Section and Connection.

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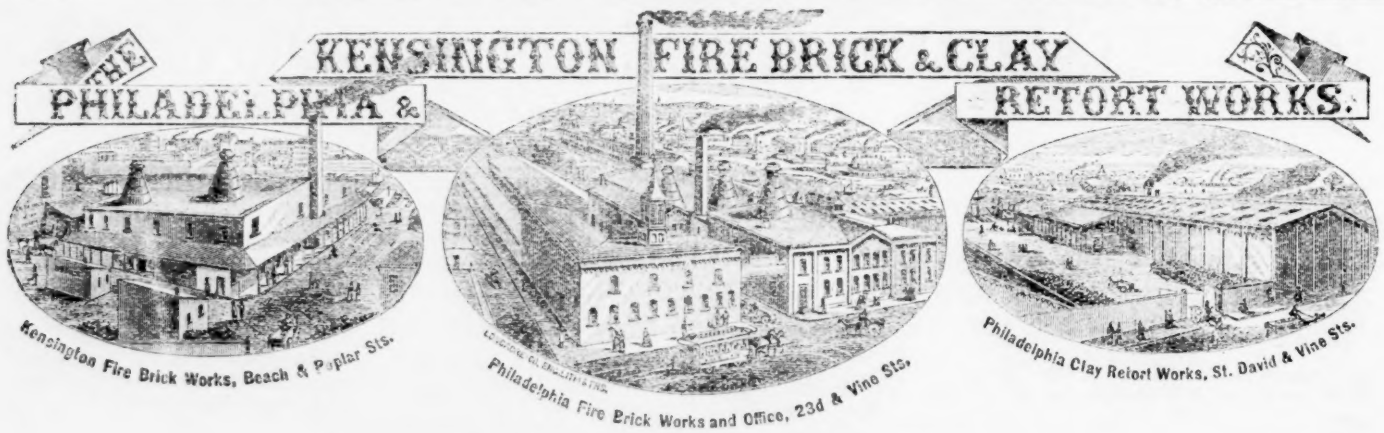
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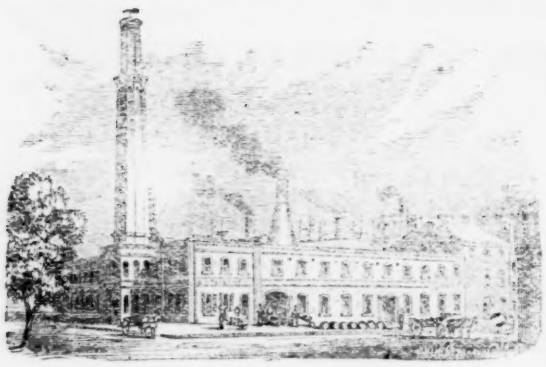

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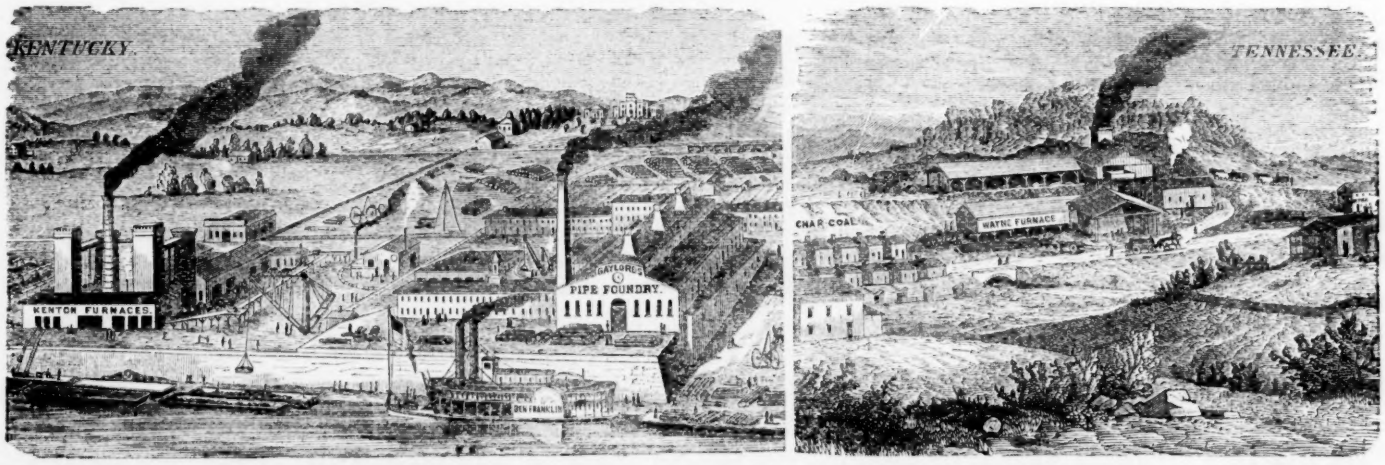

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GEO. A. McILHENNY'S

PATENT

VACUUM PROCESS,

FOR RELIEVING GAS RETORTS FROM PRESSURE.

Patented in the United States and Great Britain, June 1867 first patent for this purpose in the United States (but not pre sented to the public until fully tested). Now in successfu operation for six years, with most satisfactory results.

The many devices lately brought to the notice of the American public, to accomplish the same results are mostly old English contrivances tried and abandoned years ago, on account of the machinery, stuffing boxes, valves, levers, etc., necessary

But the extraordinary results obtained by the McIlhenny process, have induced some unprincipled persons to bring to the notice of the public, as *recent inventions of their own*, some of these old devices; their purpose seems to be simply to evade the patent.

This process is not only safe, simple and effective, but costs little to apply. The only machinery necessary is a one and a half inch stop cock, and a half inch stop cock to each bench No alteration in the old system is required. In fact, a Works operated with this process, can at any time be operated on the old pressure system, simply by closing the two stop cocks above mentioned. There is nothing to get out of order, nothing that requires special attention; no stuffing-boxes to pack and keep tight, no valves to keep clear of tar and pitch, no levers to lubricate, and no expense for a great amount of machinery.

The McIlhenny process challenges the world as regards yield and quality of gas.

For particulars apply to GEO. A. McILHENNY, Engineer of the Washington Gas-Light Co., Washington, D. C., or to WILLIAM YORKE, Engineer of the Portland Gas-Light Co., Portland, Me., who will take pleasure in corresponding with any one interested. 307-1y

GRAHAM'S

Patent Anti-Freezing LAMP POST.

THE BEST, CHEAPEST AND MOST DURABLE POST EVER OFFERED TO THE PUBLIC.

WOOSTER, OHIO Jan. 24, 1871.

J. W. GRAHAM,

Dear Sir: Yours of the 14th inst at hand. In reply I would say that we have tested the six anti-freezing Lamp Posts purchased from you, and find them to be all as you represented. Whilst nearly a dozen of our sixty-five Posts were frozen down last month and first of this not one of yours was affected by the heavy frost. What can you sell them at?

Yours truly,

LUCAS FLATTERY

Sec'y Wooster Gas-Light Co.

Address the Patentee,

J. W. GRAHAM,

250-9t Chillicothe, Ohio.

THOMAS T. TASKER Jr. STEPHEN P. M. TASKER.

MORRIS, TASKER & CO.,

PASCAL IRON WORKS, PHILADELPHIA.

TASKER IRON WORKS, NEWCASTLE. DEL.

Office, Fifth and Tasker Streets, Philadelphia.

Office and Warehouse, 15 Gold Street, New York.

Office and Warehouse 29 Pemberton Square, Boston, Mass.

Established 1821.

FOR GAS WORKS MACHINERY, ADDRESS OFFICE, FIFTH AND TASKER STREETS, PHILADELPHIA.

Manufacturers and Builders of Gas Works, &c., of all Descriptions, of the Most Approved Plans.

WROUGHT IRON ROOF FRAMES.—For Slate, or Corrugated Iron Coverings, with Cast Iron Cornice Gutter. Iron Doors and Frames, Wrought Iron Pivot Blinds, Windows and all kinds of Castings and Smith Work for Buildings.

BENCH CASTINGS.—Retorts, and all Castings and Wrought Iron Work required for Setting them on the Latest Plan. Tar Gates, Wrought Iron Stand Pipes, Retort Lids, Cotter Bars, Coal and Coke Wagons, and Stokers' Tools.

EXHAUSTERS.—Exhausters and Compensators, By-Passes to pass from 4,000 to 150,000 Cubic feet of Gas per hour, with Engines, Governors, Pressure and Vacuum Guages.

SCRUBBERS.—Single or Multitubular Scrubbers, with Self-Acting Pumps for Ammonia Water.

WASHERS.—Cataract and Single and Multitubular Spray Washers.

CONDENSERS.—Single and Multitubular Air and Water Condensers.

PURIFIERS.—For Purifying from 1,000 to 2,000,000 cubic feet capacity daily, with either wet or dry Lime, or Oxide of Iron, and with either Ash Rivetted or Wrought or Cast Iron Lime Sieves.

CARRIAGES.—Movable Lifting Carriages for Purifiers, arranged either for Floor or Overhead use.

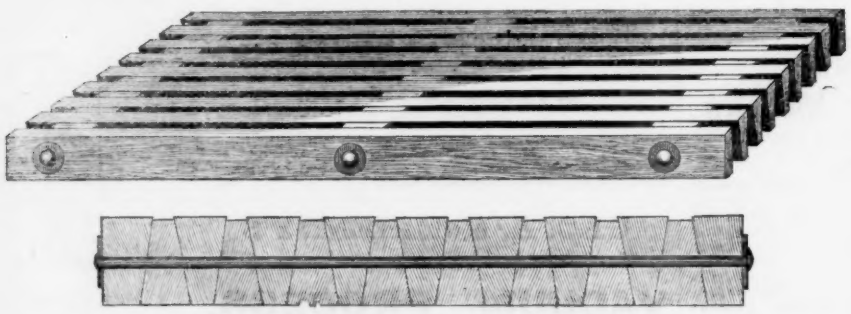
METERS.—Square and Round Meters of any capacity.

GAS HOLDERS.—Single Lift and Telescopic Gasholders, with Cast or Wrought Iron Suspension Frames.

GAS GOVERNORS.—Station Governors, with Regulating and Indicating Columns for Inlet and Outlet Pipes, also Dry Governors with Flexible Diaphragms for Underground Pipes.

STOP VALVES.—Double Faced Stop Valves for Gas or Water, from three inches to forty-eight inches diameter. These Valves are proved on both sides, with a heavy Water Pressure, Flange and Bell Pipes, Fittings and Drips of all descriptions. Steam Boilers and Hot Water Apparatus for Heating Building, and Gas Holder Tanks. Lamp Posts and Lanterns.

P. Munzinger's Patent Ash Lime Trays.



In use at the following Gas-Light Companies:

Pittsburg Gas Company, Pa.
Peoples Gas Company, Baltimore.
Lowell Gas-Light Company, Mass.
Lynn Gas-Light Company, Mass.
Albany Gas-Light Company, N. Y.
Schenectady Gas-Light Company, N. Y.
Utica Gas-Light Comwany, N. Y.
Jersey City Gas Company, N. J.
St. Paul Gas-Light Company, Minn.
Cumberland Gas-Light Company, Md.
Hartford City Gas-Light Company, Conn.
Richmond Gas Company, Va.
McKeesport Gas Company, Pa.
Middletown Gas Company, Pa.
East Newark Gas-Light Company, N. J.
Binghampton Gas Company, N. J.
Zanesville Gas Company, Ohio.

New Orleans Gas Company, La.
Salem Gas-Light Company, Mass.
New Britain Gas-Light Company, Conn.
Rahway Gas-Light Company, N. J.
Trenton Gas-Light Company, N. J.
Elmira Gas Company, New York.
Erie Gas Company, Pa.
Columbus Gas-Light Company, Ohio,
Westchester Gas-Light Company, N. Y.
Santa Cruz Gas Company, Cal.
Lawrence Gas-Light Company, Kansas.
Salem Gas Company, N. J.
Indiana Gas-Light Company, Pa.
Peoria Gas Company, Ill.
Montclair Gas Company, N. J.
Williamsport Gas Company, Pa.
Wooster Gas-Light Company, Ohio.

Augusta Gas-Light Company, Ga.
Huntsville Gas Company, Ga.
Chattanooga Gas Company Tenn.
Murfreesboro Gas Company, Tenn.
Hagerstown Gas-Light Company, Md.
Hanover Gas Company, Pa.
Easton Gas Company, Pa.
Uniontown Gas-Light Company, Pa.
Coatesville Gas-Light Company, Pa.
Houston, Gas Company, Texas.
Wilkesbarre Gas Company, La.
Middletown Gas Company, New York.
Washington Gas-Light Company, Pa.
Princeton Gas-Light Company, N. J.
Newark Gas Company, Ohio.
Pontiac Gas-Light Company, Mich.
And numerous other Companies.

APR 18 1874